DATA TRANSLATION

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DT9840 Series Getting Started Manual

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About this Manual

This manual describes how to install and set up your DT9840 Series module and device driver, and verify that your module is working properly.

Intended Audience

This document is intended for engineers, scientists, technicians, or others responsible for installing and setting up a DT9840 Series module to perform data acquisition operations. It is assumed that you are familiar with the requirements of your application. It is also assumed that you are familiar with the Microsoft®Windows® XP, Windows Vista®, or Windows 7 operating system.

How this Manual is Organized

This manual is organized as follows:

- Chapter 1, "Overview," describes the key features of the DT9840 Series hardware and software, and provides an overview of the getting started procedure.
- Chapter 2, "Preparing to Use a DT9840 Series Module," describes how to unpack the DT9840 Series package, check the system requirements, install the DT9840 Series software using Windows XP, Windows Vista, or Windows 7, build and run the example programs, and view the DT9840 Series documentation online.
- Chapter 3, "Setting up a DT9840 Series Module," describes how to apply power to the module, attach the module to the host computer, configure the device driver, and debug the module using the serial port.
- Chapter 4, "Wiring Signals," describes how to wire signals to a DT9840 Series module.
- Chapter 5, "Verifying the Operation of a Module," describes how to verify the operation of a DT9840 Series module using the DT9840 Series Download Utility.
- Chapter 6, "Programming Flash Memory," describes how to load a DSP program into the flash memory of a DT9840 Series module.
- Chapter 7, "Troubleshooting," provides information that you can use to resolve problems with a DT9840 Series module, should they occur.

An index completes this manual.

Conventions Used in this Manual

The following conventions are used in this manual:

- Notes provide useful information that requires special emphasis, cautions provide information to help you avoid losing data or damaging your equipment, and warnings provide information to help you avoid catastrophic damage to yourself or your equipment.
- Items that you select or type are shown in **bold**.
- `Courier font` is used to represent source code.

Related Information

Refer to the following documents for more information on using a DT9840 Series module:

- *DT9840 Series User's Manual* (UM-19197). This manual, included on the DT9840 Series Software CD, describes the hardware features of a DT9840 Series module, including the registers, specifications, and connector pin assignment information.
- *DT9840 Series DSP Library User's Manual* (UM-19591). This manual, included on the DT9840 Series Software CD, describes the communication and I/O functions required to write a DSP application for a DT9840 Series module.
- *DT9840 Series Host Communication Library User's Manual* (UM-19593). This manual, included on the DT9840 Series Software CD, describes how to use the DT9840 Series Host Communication Library to write a host application program that communicates with the DSP program running on a DT9840 Series module.
- Documentation for Code Composer Studio™ Integrated Development Environment (IDE) from Texas Instruments.
- Documentation for Texas Instruments TMS320C6713 DSP processor.
- Microsoft XP, Windows Vista, or Windows 7 documentation.
- Microsoft Visual Studio documentation.
- USB 1.1 and USB 2.0 specifications available on the USB web site (http://www.usb.org).

Where to Get Help

Should you run into problems installing or using a DT9840 Series module, the Data Translation Technical Support Department is available to provide technical assistance. Refer to page 79 for more information. If you are outside the U.S. or Canada, call your local distributor, whose number is listed on Data Translation's web site (www.datatranslation.com).

Overview

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Features

The DT9840 Series data acquisition modules provide digital signal processing (DSP) and control capabilities for the Universal Serial Bus (USB). DT9840 Series module resides outside of the host computer and attach to the host computer with a single USB cable to ease installation. Modules can be "hot swapped" or plugged and unplugged while the host computer is on, making them useful for many data acquisition applications.

Currently, the DT9840 Series consists of the DT9841, DT9841E, DT9841-VIB, DT9842/2, and DT9842/8 modules.

The DT9841, DT9841-VIB, DT9842/2, and DT9842/8 modules provide 8 analog input channels and support the Scalable Bus for connecting up to four modules together. The DT9841E provides 2 analog input channels and does not support the Scalable Bus. The DT9840 Series modules provide the following major features:

- USB 2.0 and 1.1 compatibility.
- Software programmable floating-point DSP and control functions running on the module.
- Isolated output common from the USB bus to 500 V peak.
- For the DT9841-VIB module, two 8-bit ports that you can program for digital input or digital output; port 0, if configured for digital input, supports interrupt-on-change on all eight bits.

  For all other DT9840 Series modules, three 8-bit ports that you can program for digital input or digital output; port 0, if configured for digital input, supports interrupt-on-change on all eight bits.
- Three programmable 32-bit user counter/timer channels that support event counting, frequency measurement, rate generation, one-shot, repetitive one-shot, and up/down counting.
- Internal and external sample clock sources.
- Continuous sampling and output rates of up to 100 kSamples/s per channel.
- Internal and external trigger sources.
- Serial port for connecting an RS-232-compliant device for debugging.
- JTAG port for direct support from third-party debug devices, such as the XDS510 or Blackhawk emulator.

Table 1 describes the key differences among the modules.

Table 1: DT9840 Series Modules

Models	Analog Inputs	Converter Type	Resolution	Sampling Rate	Analog Filtering	Analog Outputs	Scalable Bus
DT9841	8DI[a]	Delta-Sigma	24-bit[b]	200 Hz to 100 kHz	Yes[c]	2[d]	Yes
DT9841-VIB[e]	8SE[a]	Delta-Sigma	24-bit[b]	200 Hz to 100 kHz	Yes[c]	2[d]	Yes
DT9841E	2DI[a]	Delta-Sigma	24-bit[b]	200 Hz to 100 kHz	Yes[c]	2[d]	No
DT9842/2	8SE[a]	Successive Approximation	16-bit[b]	0 Hz to 100 kHz	No	2[f]	Yes
DT9842/8	8SE[a]	Successive Approximation	16-bit[b]	0 Hz to 100 kHz	No	8[f]	Yes

a. DI refers to differential mode and SE refers to single-ended mode. For differential inputs only, you can configure the termination resistance in software on a channel-by-channel basis.
b. The input signal range is ±10 V.
c. Software-selectable output filters of 5 kHz and 20 kHz are available.
d. Software-selectable output ranges of ±10 V and ±2.5 V are available.
e. The DT9841-VIB supports IEPE (Integrated Electronic Piezoelectric) functions on the analog input channels, allowing you to connect IEPE inputs. The DT9841-VIB module has two 8-bit digital I/O ports, where the standard DT9841 product has three 8-bit digital I/O ports.
f. The output signal range is ±10 V.

Figure 1 shows the board layout of the DT9841, DT9842/2, and DT9842/8 modules. Figure 2 shows the board layout of the DT9841E module.

Note: The DT9841-VIB version is available in the Sleek Box configuration only.

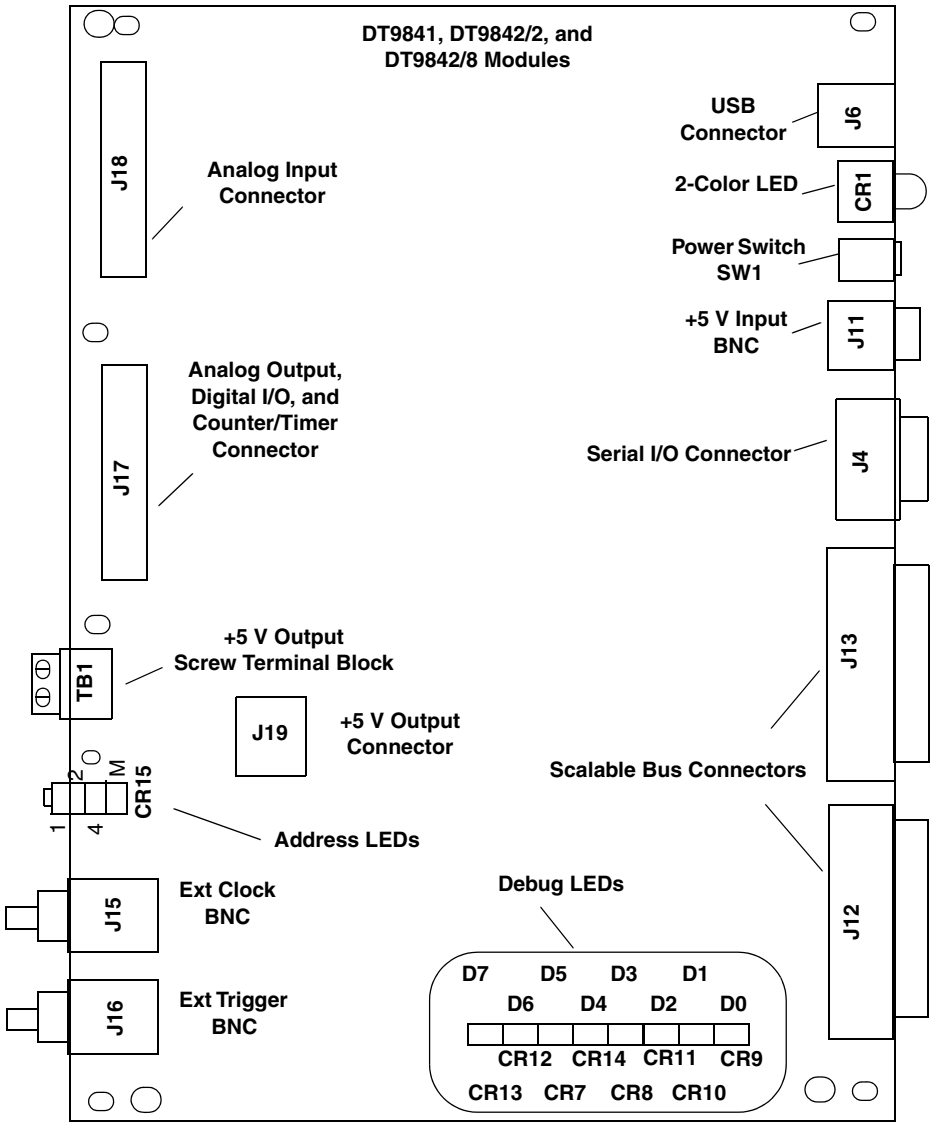

Figure 1: Layout of the DT9841, DT9842/2, and DT9842/8 Modules (Board-Level Version)

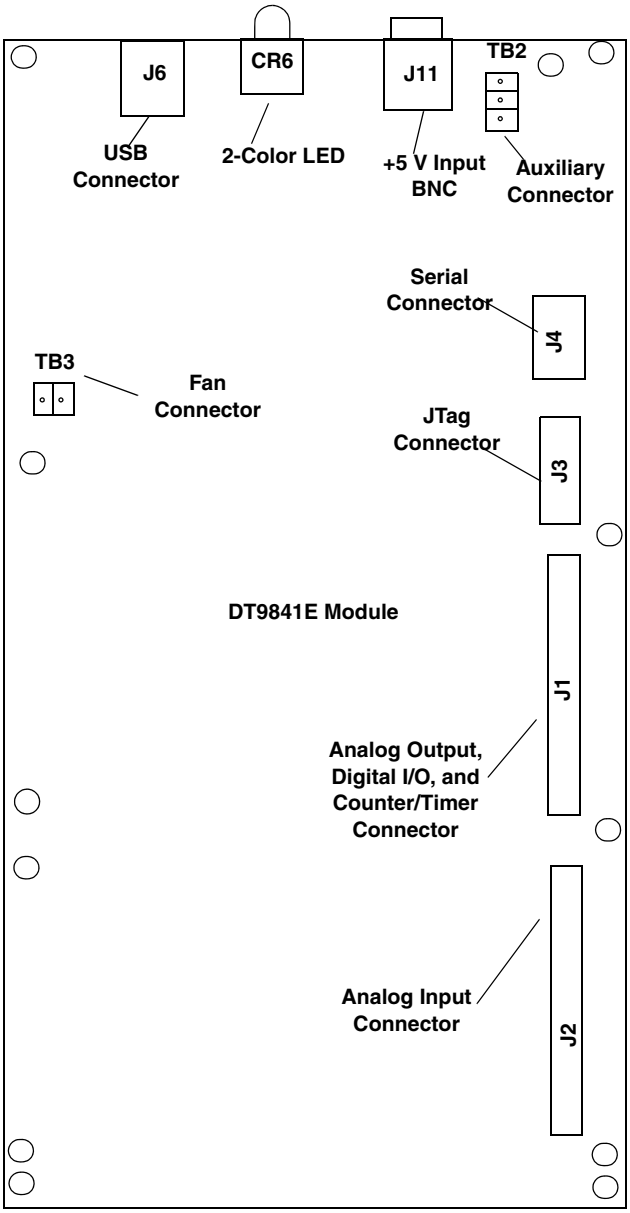

Figure 2: Layout of the DT9841E Module (Board-Level Version)

Supported Software

The following software is provided on the DT9840 Series Software CD that is shipped with DT9840 Series modules:

- **DT9840 Series Device Driver** – The DT9840 Series Device Driver provides the low-level support for DT9840 Series modules. You must install the DT9840 Series Device Driver to use any of the supported software packages or utilities for DT9840 Series modules. Refer to page 19 for more information on installing the device driver.
- **DT9840 Series DSP Library** – The DT9840 Series DSP Library provides I/O and communication functions that you can call from a DSP application program on a DT9840 Series module using Code Composer Studio from Texas Instruments. Refer to the *DT9840 Series DSP Library User's Manual* for more information on using the DT9840 Series DSP Library.
- **DT9840 Series Host Communication Library** – The DT9840 Series Host Communication Library provides functions that you can call from a host application program using Microsoft Visual Studio to allow communication between the host and a DT9840 Series module. Refer to the *DT9840 Series Host Communication Library User's Manual* for more information on using the DT9840 Series Host Communication Library.
- **DT9840 Series Download Utility** – The DT9840 Series Download Utility allows you to download a DSP program (that conforms to the Code Composer Studio standard) into the SDRAM of a DT9840 Series module, run the DSP program, and perform memory and LED tests on the module. Refer to Chapter 5 starting on page 61 for more information on using the DT9840 Series Download Utility.
- **DT9840 Series Flash Programmer Utility** – The DT9840 Series Flash Programmer Utility allows you to download a DSP program (that conforms to the Code Composer Studio standard) into the flash memory of a DT9840 Series module. Refer to Chapter 6 starting on page 71 for more information on using the DT9840 Series Flash Programmer Utility.
- **Example Programs** –Example programs are provided that illustrate how to call the functions in the DT9840 Series Host Communication Library and DT9840 Series DSP Library. Refer to page 20 for information on building and running these example programs.
- **DT9841 Calibration Utility** – The DT9841 Calibration Utility allows you to calibrate the analog I/O circuitry of a DT9841 or DT9841E module. Refer to the *DT9840 Series User's Manual* for more information on using this utility.

Supported Configurations

You can purchase a DT9840 Series module in one of the following configurations; all configurations include a DT9840 Series Software CD and a 1.83-meter USB cable (EP365) that connects the USB connector of the module to the USB connector on the host computer:

- Board-level configuration – The following board-level configurations are available for OEM embedded applications:
  - **DT9841** – DT9841 module with 8 analog inputs, 2 analog outputs, 3 digital I/O ports, 3 counter/timer channels, 128 MBytes of SDRAM memory, and 2 MB of flash memory packaged in a 6U board-level configuration.
  - **DT9841E** – DT9841E module with 2 analog inputs, 2 analog outputs, 3 digital I/O ports, 3 counter/timer channels, 128 MBytes of SDRAM memory, and 2 MB of flash memory packaged in a board-level configuration.
  - **DT9842/2** – DT9842/2 module with 8 analog inputs, 2 analog outputs, 3 digital I/O ports, 3 counter/timer channels, 128 MBytes of SDRAM memory and 2 MB of flash memory packaged in a 6U board-level configuration.
  - **DT9842/8** – DT9842/8 module with 8 analog inputs, 8 analog outputs, 3 digital I/O ports, 3 counter/timer channels, 128 MBytes of SDRAM memory, and 2 MB of flash memory, packaged in a 6U board-level configuration.
- Sleek Box configuration – The Sleek Box configuration packages the board-level version of the module in a CE-compliant box with standard signal connectors, power supply, and fan. The following Sleek Box configurations are available:
  - **DT9841-SB** – DT9841 module with 128 MBytes of SDRAM memory and 2 MB of flash memory, packaged in the Sleek Box configuration.
  - **DT9841-VIB-SB** – DT9841-VIB module with 8 analog inputs that provide IEPE functions, 2 analog outputs, and 2 digital I/O ports, 3 counter/timer channels, 128 MBytes of SDRAM memory, and 2 MB of flash memory, packaged in the Sleek Box configuration.
  - **DT9842/2-SB** – DT9842/2 module with 128 MBytes of SDRAM memory and 2 MB of flash memory, packaged in the Sleek Box configuration.
  - **DT9842/8-SB** – DT9842/8 module with 128 MBytes of SDRAM memory and 2 MB of flash memory, packaged in the Sleek Box configuration.

Note: The DT9841E module is not available in the Sleek Box configuration.

- Developer's Kit configuration – The **DT9841E-DK** configuration provides a complete solution for developing applications for the DT9841E module. This kit includes the DT9840 Series CD, the DT9841E module, the EP365 USB cable, the EP348 power supply, the EP358E accessory panel for easy signal connections, and two EP344 cables to connect the EP358E accessory panel to the DT9841E module. Refer to page 14 for more information on the included accessories.

Accessories

You can purchase the following optional items separately from Data Translation for use with the DT9840 Series:

- **EP342** – A 0.2-meter, shielded cable that connects multiple DT9840 Series modules together using the Scalable Bus. Note that this accessory is not available for the DT9841E module.
- **EP354** – An RS-232 serial adapter that has one 9-pin D-sub male connector on one end and a 9-pin D-sub female connector on the other end. The EP354 serial adapter connects to the serial port of a DT9840 Series module and to the EP335 cable, which is shipped with the EP354 serial adapter.

Note: To attach the DT9841E to the EP354 serial adapter, you need the EP368 cable that comes with the EP354. The EP368 cable is a 6-inch cable that has a 10-pin connector on one end for attaching to the J4 connector on the DT9841E and a 9-pin D-sub, female connector on the other end for attaching to the EP354 serial adapter.

The EP335 cable that comes with the EP354 serial adapter is a 9-pin, 2-meter cable that has one 9-pin D-sub male connector on one end and a 9-pin D-sub female connector on the other end. The EP335 cable connects the EP354 serial adapter board to an RS-232-compliant device.

- **EP348** – An external +5 V, 6 A, switching power supply for the module. This power supply includes a 4-pin locking connector for attaching the power supply to the J11 connector on the module and a cable that connects the power supply to a wall outlet.

  The EP348 power supply is included when you purchase a Sleek Box version of the module.

- **EP358E** – An accessory panel that connects to the DT9841E module. The EP358E provides BNCs for all analog I/O connections, and three connectors that allow access to all of the signals on the module. Two EP344 cables are provided with the EP358E accessory panel.

  The EP344 is a 6-inch, 68-pin ribbon cable that connects one of the two 68-pin connectors on the back of the EP358E accessory panel to one of the two 68-pin connectors on the DT9841E module. Refer to page 34 for connection information.

2

Preparing to Use a DT9840 Series Module

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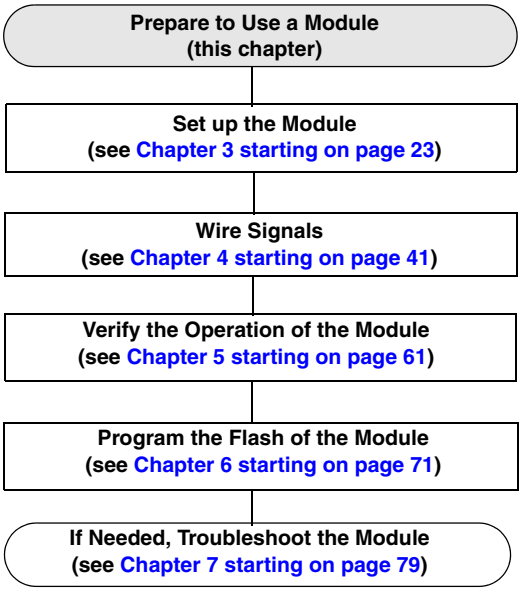

Prepare to Use a Module
(this chapter)
Set up the Module
(see Chapter 3 starting on page 23)
Wire Signals
(see Chapter 4 starting on page 41)
Verify the Operation of the Module
(see Chapter 5 starting on page 61)
Program the Flash of the Module
(see Chapter 6 starting on page 71)
If Needed, Troubleshoot the Module
(see Chapter 7 starting on page 79)

Unpacking

Open the shipping box and verify that the following items are present:

- DT9840 Series module (if you purchased a Sleek Box configuration, the module will be enclosed inside the Sleek Box)
- EP365 USB cable
- DT9840 Series Software CD

Note: If you ordered the DT9840 Series module in a Sleek Box configuration, make sure that you also received the power supply (EP348).

If you ordered the DT9841E-DK developer's kit, make sure that you also received the power supply (EP348), the accessory panel (EP358E), and two cables for connecting the EP358E accessory panel to the module (EP344).

If an item is missing or damaged, contact Data Translation. If you are in the United States, call the Customer Service Department at (508) 481-3700, ext. 1323. An application engineer will guide you through the appropriate steps for replacing missing or damaged items. If you are located outside the United States, call your local distributor, listed on Data Translation's web site (www.datatranslation.com).

Once you have unpacked your module, check the system requirements, as described in the next section.

Checking the System Requirements

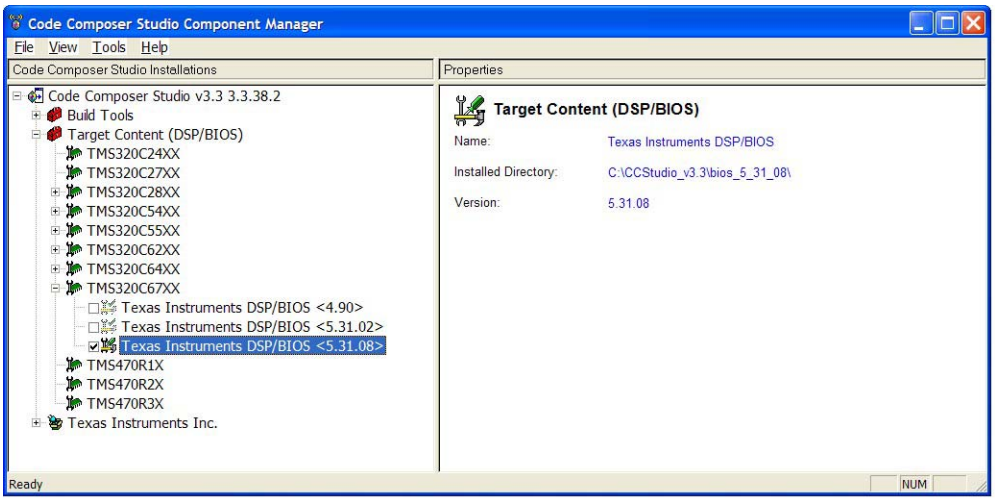
For reliable operation, your DT9840 Series module requires the items listed in Table 2.

Table 2: Minimum System Requirements

Feature	Minimum Requirements
Texas Instruments Code Composer Studio (CSS) and TI DSP/BIOS	CCS Version 3.3 and TI DSP/BIOS 5.31.08 or CCS Version 5.2.1 and TI DSP/BIOS 5.41.13.42
Microsoft Visual Studio	Version 6.0 or greater
Operating System	Windows XP professional edition, Windows Vista, or Windows 7[a]
Processor	Pentium 233 MHz or higher
USB Ports	One or more (version 1.1 or 2.0)
RAM	64 MB or more; 128 MB or higher is recommended
CD-ROM Drives	One or more
Monitor	Super VGA, or compatible, display (800 x 600 or higher is recommended)

a. For USB 2.0 support, install Service Pack 2 for Windows XP. Note that for some PCs, you may also need to disable standby mode on your system. If you are unsure of whether you are using USB 2.0 or USB 1.1, run the Data Translation DT9840 Series Control Panel, described on page 31. Consult Microsoft for more information.

Note that the DT9840 Series DSP Library and all example programs require Code Composer Studio version 3.3 and TI DSP/BIOS 5.31.08, or Code Composer Studio version 5.2.1 and TI DSP/BIOS 5.41.13.42. To verify that the correct version of the TI DSP/BIOS is selected, run the CCS Component Manager, and ensure that the correct version of the TI DSP/BIOS is selected. In a typical installation, you can find the CCS Component Manager in the following path: C:\CCStudio_v*x.x*\cc\bin\comp_mgr.exe (where *x.x* is the version of Code Composer).



Installing the Software

Notes: Make sure that you have Administrator rights before installing the DT9840 Series software. Refer to Appendix B for information on ensuring that your system has the proper permissions.

If you are using both Code Composer Studio and a JTag emulator, make sure that you install Code Composer Studio before installing the JTag emulator. You can install the DT9840 Series software either before or after you install the Code Composer Studio software. However, ensure that the DT9840 Series software is installed before attempting to install a DT9840 Series module.

To install the software, do the following:

1. Insert the DT9840 Series Software CD into your CD-ROM drive.
2. Click **Start** from the Task Bar, and then click **Run**.
   The Run dialog box appears.
3. In the Command Line edit box, enter **D:\SETUP.EXE**.
   If your CD-ROM is not in drive D:, enter the letter of the drive where your CD-ROM is located.
   The InstallShield Wizard for the DT9840 Series appears.
4. Click **Next**.
   The wizard prompts you to select a module type.
5. Select the DT9840 Series module type you are using (DT9841, DT9841E, DT9841-VIB, DT9842/2, or DT9842/8), and then click **Next.**
6. Select the type of installation to perform (Full, Compact, or Custom), the click **Next**.
7. Either change the directory path and/or name using **Browse** or accept the default directory, and then click **Next**.
   The wizard prompts you for the program folder name.
8. Either enter a new name for the program folder or accept the default name, and then click **Next**.
   The files are copied. When installation is complete, the wizard prompts you to read the ReleaseNotes.txt file now or later.
9. Click **Yes** to read the release notes now. Otherwise, click **No**.

Building and Running the Example Programs

A number of example programs are provided with the DT9840 Series software. As shipped, these examples are provided in source-code form. Refer to the Readme file on the CD for a list of the examples and what they demonstrate.

The source code and project files for all examples are installed, by default, in the following locations:

For 32-bit Windows:

\Program Files\Data Translation\DT9840 Series\Examples

For 64-bit Windows:

\Program Files (x86)\Data Translation\DT9840 Series\Examples

DSP Programs

The DSP programs are installed in the subfolder named *DSP* under each example folder. DSP programs are built with TI Code Composer Studio.

Note: Refer to the *DT9840 Series DSP Library User's Manual* for instructions on creating your own DSP programs for aDT9840 Series module.

Building the DSP Example Programs in Code Composer 3.3

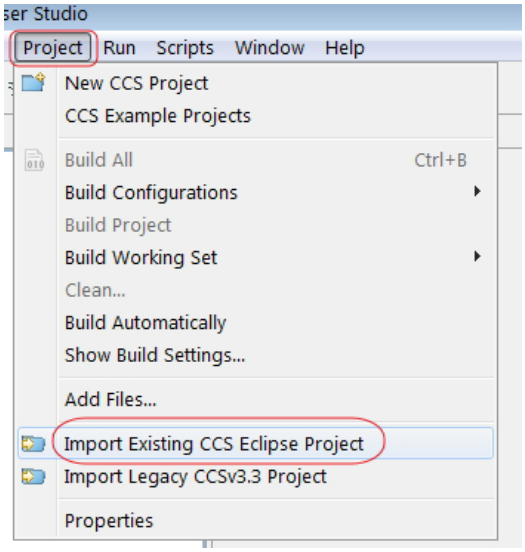
To build the DSP example programs in Code Composer 3.3, perform the following steps:

1. Open the DSP project in the Code Composer 3.3 IDE using the menu **Project** -> **Open**.
2. Select a file with the .pjt extension.
3. Build the project using the menu option **Project** -> **Rebuild all**.

Building DSP Programs in Code Composer 5.2.1

To build the DSP example programs in Code Composer 5.2.1, perform the following steps:

1. Start Code Composer Studio 5.2.1.
2. From the **Project** menu, select **Import Existing CCS Eclipse Project**.



3. Browse to the folder that contains the DSP projects for the examples that you want to build.
   Eclipse automatically discovers all projects in that folder and all subfolders and displays them.
4. Check the projects that you wish to import.
5. Click **Finish**.
   The projects are imported into the Code Composer Studio Eclipse IDE.

Host Applications

Several examples have a host application that communicates and interacts with the DSP program that reside in the DSP on the DT9840 Series module. Host applications are installed in the subfolder named *Host* under each example folder. Host applications are built using Microsoft Visual Studio 10 or higher.

To build a host example application, perform the following steps:

1. Start Microsoft Visual Studio.
2. Open the solution (.sln) file.
3. Rebuild the solution.

Note: Refer to the *DT9840 Series Host Communication Library User's Manual* for instructions on creating your own host application that communicates with aDT9840 Series module.

Viewing the Documentation Online

Once you have installed the DT9840 Series software, you can view the DT9840 Series documentation by clicking the manual title. You can access the manuals from the Data Translation, Inc\DT9840 Series program group.

To view the documentation, you need Adobe Acrobat Reader, version 6.0 or greater, which is available from www.adobe.com.

Here are a few helpful hints about using Adobe Acrobat Reader:

- To navigate to a specific section of the document, click a heading from the table of contents on the left side of the document.
- Within the document, click the text shown in blue to jump to the appropriate reference (the pointer changes from a hand to an index finger).
- To go back to the page from which the jump was made, click the right mouse button and **Go Back,** or from the main menu, click **Document**, then **Go Back.**
- To print the document, from the main menu, click **File**, and then **Print**.
- To increase or decrease the size of the displayed document, from the main menu, click **View**, and then **Zoom**.
- By default, text and monochrome images are smoothed in Acrobat Reader, resulting in blurry images. If you wish, you can turn smoothing off by clicking **File**, and then **Preferences/General**, and unchecking **Smooth Text and Images**.

Setting up a DT9840 Series Module

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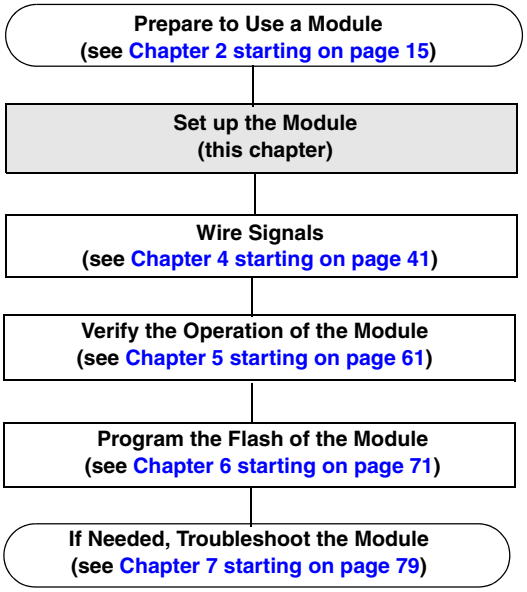
Prepare to Use a Module
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Wire Signals
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(see Chapter 5 starting on page 61)
Program the Flash of the Module
(see Chapter 6 starting on page 71)
If Needed, Troubleshoot the Module
(see Chapter 7 starting on page 79)

Note: DT9840 Series modules are factory-calibrated and require no further adjustment.

To set up a DT9840 Series module, you must do the following:

1. Apply power to the module, as described on page 25
2. Attach the module to the host computer, as described on page 26
3. Configure the module, as described on page 31
4. For DT9841E users, connect the optional EP358E accessory panel to the module, as described on page 34
5. If desired, set up the module for serial debugging, as described on page 35

Applying Power to a DT9840 Series Module

DT9840 Series modules require an external +5 V power supply, such as the EP348, that is isolated from the computer or from the power commons (up to 500 V minimum).

Note: The EP348 is shipped with all Sleek Box models and the DT9841E-DK developer's kit and is available separately as an accessory to the DT9840 Series.

To apply power to a DT9840 Series module, do the following:

1. Connect the +5 V power supply (EP348 or equivalent) to the +5 V input connector (J11) on the DT9840 Series module. Figure 3 on page 25 shows how to connect the EP348 to the Sleek Box version of the module.
2. Plug the power supply to a wall outlet, and then turn on the power supply.
3. Press the power switch, SW1, on the DT9840 Series module.
   If the power supply is attached correctly to the module, LED CR1, shown in Figure 3, turns green.

Note: If you are using the DT9841E module, the LED is labelled CR6, not LED CR1; the power is turned on automatically when the power supply is turned on. Refer to page 11 for the layout of the DT9841E module.

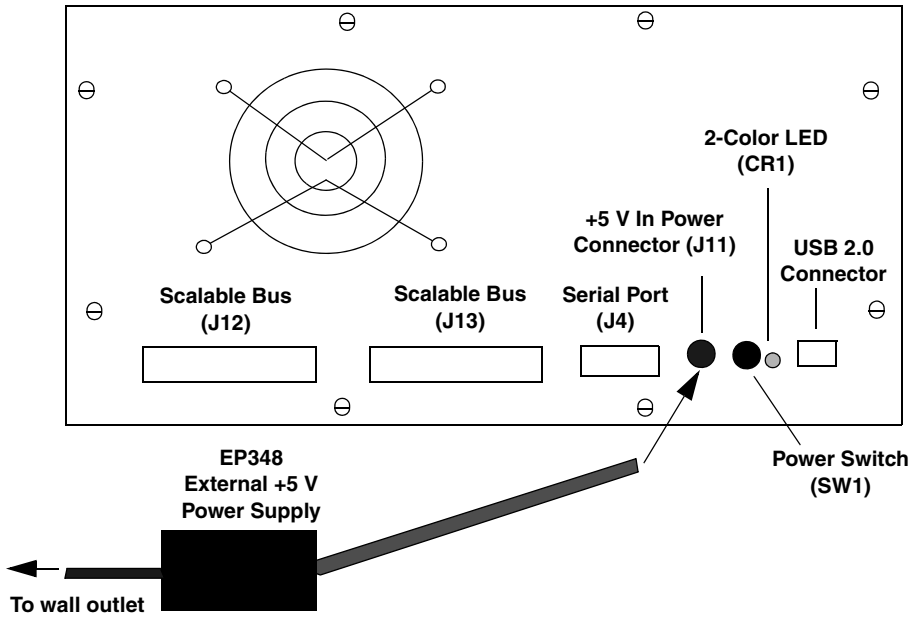


Figure 3: Attaching a +5 V External Power Supply to a DT9840 Series Module

Now, you can attach the module to the host computer, as described in the next section.

Attaching the Module to the Computer

You can attach a DT9840 Series module to the host computer in one of three ways:

- Connect one or two modules directly to the USB ports of your host computer, described on this page. This method is recommended if you want to use one or two modules independently.
- Connect up to four modules (one master and three slaves) together using the Scalable Bus and the EP342 cable, described on page 27. This method is recommended if you want to synchronize the operation of up to four modules.

Note: If you are using DT9841E modules, this method is not supported.

- Connect multiple modules to one or more self-powered USB hubs, described on page 29. This method is recommended if you want to use more than two modules independently.

Notes: The practical number of modules that you can attach to your host computer using a self-powered hub depends on the bandwidth of the USB bus and your application.

Once a module is plugged in, you can unplug a module, then plug it in again, if you wish, without causing damage. This process is called hot-swapping. Your application may take a few seconds to recognize a module once it is plugged back in.

Connecting Directly to the Host Computer

Note: Install the software using the instructions on page 19 before performing this procedure.

Generally, host computers have one or more USB ports. These ports are completely independent from one another. If you want to connect up to two DT9840 Series modules directly to the host computer and access them independently, do the following:

1. Attach one end of the USB cable (EP365), which is shipped with the DT9840 Series module, to the USB connector (J6) on the module. Figure 4 shows how to connect the USB cable to the Sleek Box version of a module.
2. Attach the other end of the USB cable to the USB 2.0 port of the your host computer. *The operating system automatically detects the USB device, downloads and starts the firmware (LED CR1, shown in Figure 4, turns red), and loads and starts the Windows driver (LED CR1 turns orange).*

Notes: If you are using the DT9841E module, the LED is labelled CR6, not LED CR1. Refer to page 11 for the layout of the DT9841E module.

USB 1.1 is also supported, but at USB 1.1 transfer rates.

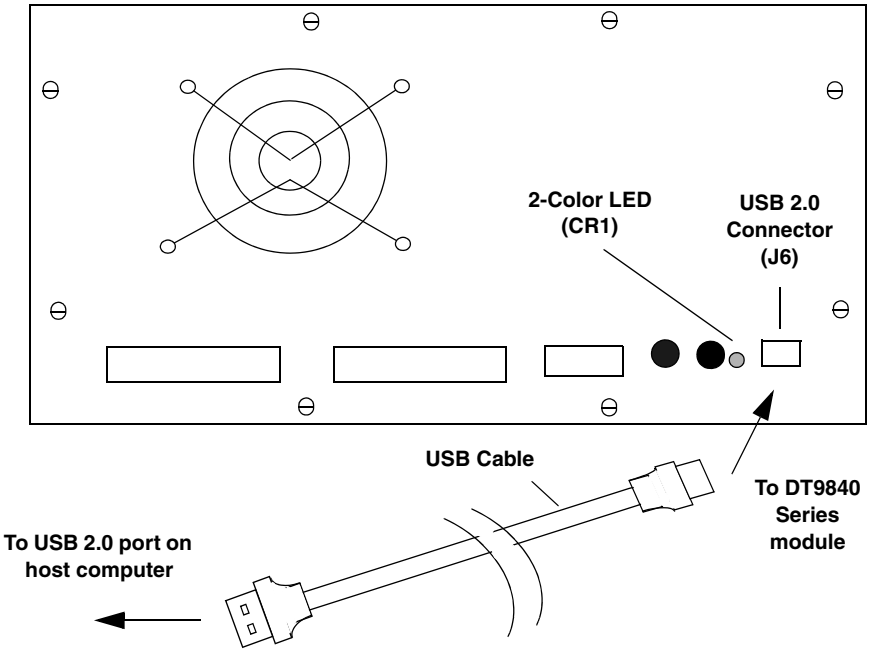


Figure 4: Attaching DT9840 Series Modules Directly to the Host Computer

3. Repeat steps 1 to 2 to attach another DT9840 Series module to the host computer, if desired.

You can now configure the module, as described on page 31.

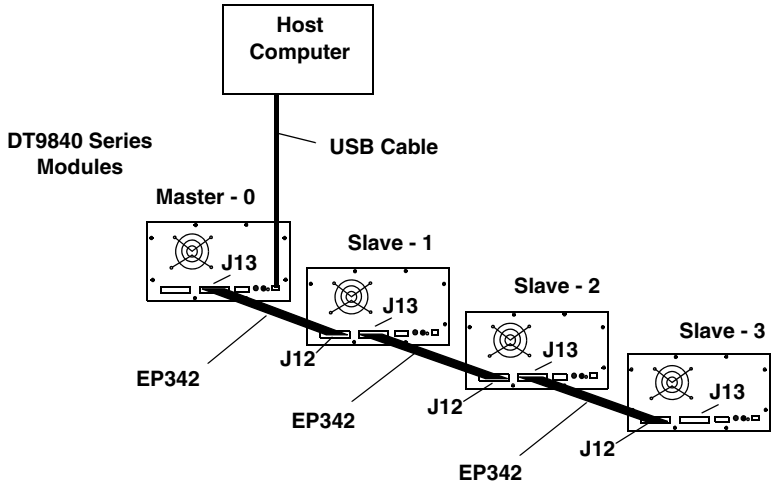
Connecting Modules Together through the Scalable Bus

Note: Install the software using the instructions on page 19 before performing this procedure.

Skip this procedure if you are using a DT9841E; the DT9841E does not support the Scalable Bus.

To connect up to four DT9840 Series modules together and to the host computer, do the following:

1. For the first module in the chain (known as the master), attach one end of the USB cable (EP365), which is shipped with the module, to the USB connector (J6) on the module; attach the other end of the USB cable to one of the USB ports on the host computer, as shown in Figure 4 on page 27.
   The operating system automatically detects the USB device, downloads and starts the firmware (LED CR1, shown in Figure 4 on page 27, turns red), and loads and starts the Windows driver (LED CR1 turns orange).
2. Attach one end of the EP342 cable to one of the Scalable Bus connectors (J12 or J13) on the master module; attach the other end of this cable to one of the Scalable Bus connectors (J12 or J13) on the next DT9840 Series module in the chain, known as a slave, as shown in Figure 5.
   The operating system automatically detects the USB devices as they are installed.



Note that you must configure the address of each of the module in the chain and terminate both the master module and the last slave module in the chain using the Data Translation DT9840 Series Control Panel, described on page 31.

Figure 5: Attaching Multiple DT9840 Series Modules Together

3. Repeat step 2 until you have attached the number of DT9840 Series modules that you desire (up to four – one master and up to three slaves).

Now, configure the modules, as described on page 31.

Connecting to a Self-Powered USB Hub

Self-powered USB hubs are USB hubs that are powered by their own external power supply. Theoretically, you can connect up to five self-powered USB hubs to a USB port on the host computer. Each of these hubs supports up to four DT9840 Series modules that you can use independently. However, the practical number of DT9840 Series modules that you can connect to a single USB port depends on the throughput you want to achieve.

Note: Install the software using the instructions on page 19 before performing this procedure.

To connect a DT9840 Series module to a self-powered USB hub, do the following:

1. Attach one end of the USB cable (EP365) to the USB connector (J6) on the DT9840 Series module and the other end of the USB cable to a USB 2.0 port on a self-powered USB hub, as shown in Figure 6.

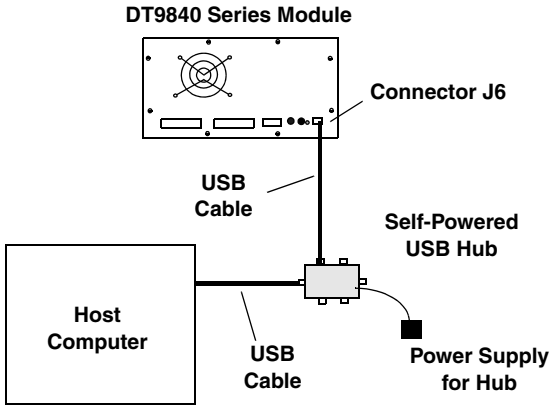


Figure 6: Attaching a DT9840 Series Module to a Self-Powered Hub

2. Connect the power supply for the self-powered USB hub to an external power supply, as shown in Figure 6 on page 29.
3. Connect the hub to the USB port on the host computer using another USB cable, as shown in Figure 6 on page 29.
   The operating system automatically detects the USB device, downloads and starts the firmware (LED CR1, shown in Figure 3, turns red), and loads and starts the Windows driver (LED CR1 turns orange).

Note: If you are using the DT9841E module, the LED is labelled CR6, not LED CR1. Refer to page 11 for the layout of the DT9841E module.

4. Repeat steps 1 to 3 until you have attached the number of hubs (up to five) and DT9840 Series modules (up to four per hub) that you desire, as shown in Figure 7.
   The operating system automatically detects the USB devices as they are installed.

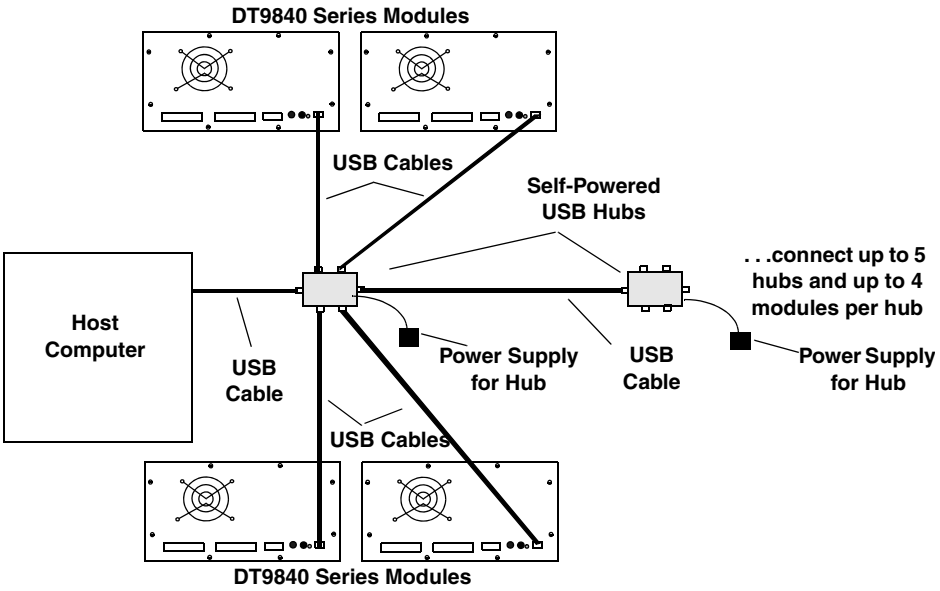


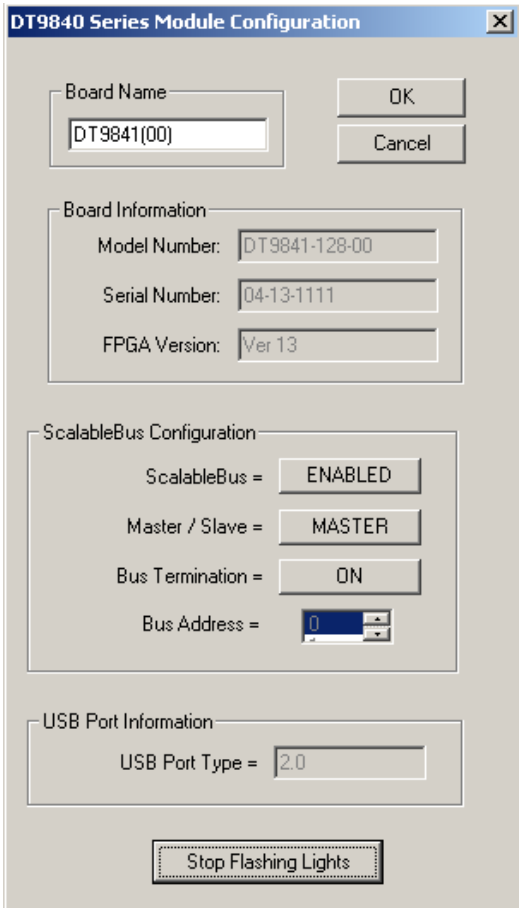
Figure 7: Attaching Multiple DT9840 Series Modules to the Host Computer Using Self-Powered USB Hubs

You can now configure the modules, as described on page 31.

Configuring DT9840 Series Modules

To configure the DT9840 Series modules, do the following:

1. From the Control Panel on the host computer, double-click the **Data Translation DT9840 Series Control Panel** icon.
   The DT9840 Series Module Configuration dialog box appears:



2. Click the name of the DT9840 Series module that you want to configure.
   The module number, serial number that was factory-programmed on the module, revision of the FPGA on the module, and the USB port type (2.0 or 1.1) are displayed.
3. If you want to change the name of the module, enter a new name in the Board Name field, overwriting the default name. This name is applied when you click the **OK** button.
4. If you are using the Scalable Bus to connect up to three slave modules to the master module, do the following:
   a. Enable operation of the Scalable Bus.
   b. Configure the first module in the chain as the Master, and specify Bus Termination as On.
      Bus Address 0 is automatically selected and position M of Address LED (CR15) is turned on. Refer to Figure 8 for the location of this LED.

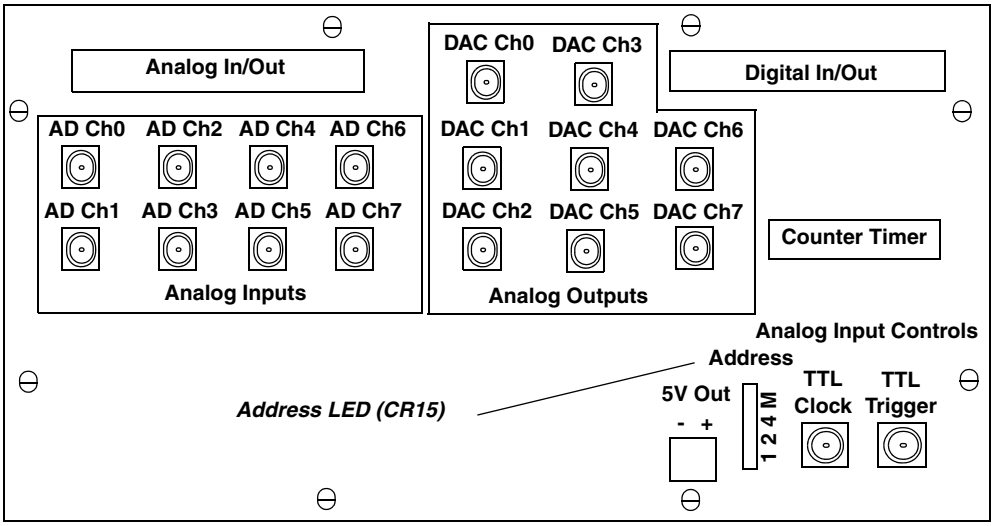


Figure 8: Address LED (CR15)

c. Configure the last module in the chain as a Slave, specify Bus Termination as On, and specify a unique Bus Address from 1 to 3.
Positions 1 and 2 of Address LED (CR15) are turned on, as needed, to represent addresses 1 to 3. For example, if you specify an address of 1, only position 1 of CR15 is turned on. If you specify an address of 3, positions 1 and 2 of CR15 are turned on.

d. Configure all the modules in the middle of the chain as Slaves, specify Bus Termination as Off, and specify a unique Bus Address from 1 to 3.
Positions 1 and 2 of Address LED (CR15) are turned on, as needed, to represent addresses 1 to 3. For example, if you specify an address of 1, only position 1 of CR15 is turned on. If you specify an address of 3, positions 1 and 2 of CR15 are turned on.

5. Click **OK**.
6. Close the DT9840 Series Control Panel.
7. Use software to configure the modules for synchronous or asynchronous operation.

   For synchronous operation, where all slave modules operate at the frequency of the master clock source, set the clock source for each slave module to Scalable Bus master clock. In this configuration, you can set the clock source for the master module to either internal or external. (If you select external, ensure that you attach a clock signal to the Ext Clk BNC on the master module.) The master clock and reset signals are then provided to the slaves through the Scalable Bus connections.

   For asynchronous operation, you can set the clock source for both the master and slave modules to either internal or external (but not to Scalable Bus master). Each module is then clocked separately; you can communicate with all the modules on the bus using software. If you are using a DT9841E module, select asynchronous operation.

Note: When you are addressing a slave from the master module, the address LEDs (CR15) on the master are turned on to indicate both the master module and the slave module that is being addressed. For example, if you are using the master to communicate to a slave module with an address of 1, position 3 (M) of address LED CR15 is turned on to indicate that the module is configured as a master, and position 1 of address LED CR15 is turned on to indicate that the master is communicating with a slave module whose address is 1.

When the master is broadcasting to all slave modules, no address LEDs (CR15) are turned on.

Attaching the EP358E Accessory Panel to a DT9841E Module

Note: Skip this section if you did not purchase the DT9841E-DK developer's kit or EP358E accessory panel.

Data Translation provides the optional EP358E accessory panel to make connecting signals to the DT9841E module easier. To attach the EP358E accessory panel to the DT9841E module, do the following:

1. Attach one end of an EP344 cable, included with the EP358E, to the J202 connector on the back of the EP358E accessory pane.
2. Attach the other end of this cable to the J2 connector on the DT9841E module, as shown in Figure 9.
3. Using the remaining EP344 cable, attach one end of the cable to the J201 connector on the back of the EP358E accessory panel and the other end of this cable to the J1 connector on the DT9841E module, as shown in Figure 9.

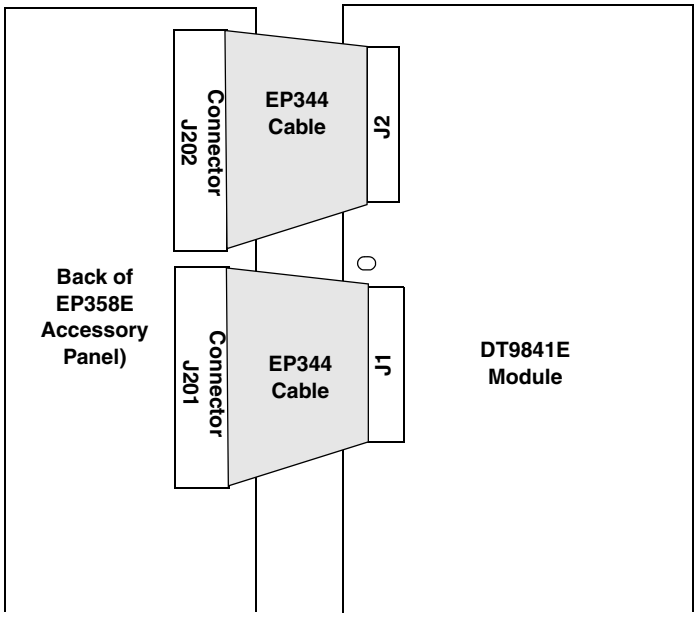


Figure 9: Attaching the EP344 Cables to the EP358E and DT9841E Module

You are now ready to wire signals to the EP358E accessory panel using the instructions in Chapter 4 starting on page 41.

Setting up the Module for Debugging Using the Serial Port

Note: Skip this section if you do not want to use the serial port on the DT9840 Series module for debugging purposes.

If you want to debug the operation of the DT9840 Series module using the J4 serial port, you need the optional EP354 serial adapter.

Do the following to set up the module for serial debugging:

1. If you are using the DT9841E, attach the 10-pin connector of the EP368 cable into the J4 connector on the DT9841E module, and then connect the 9-pin D-sub connector on the other end of the EP368 cable into the male connector of the EP354 serial adapter, securing it with the two retaining screws on the EP354, as shown in Figure 10.

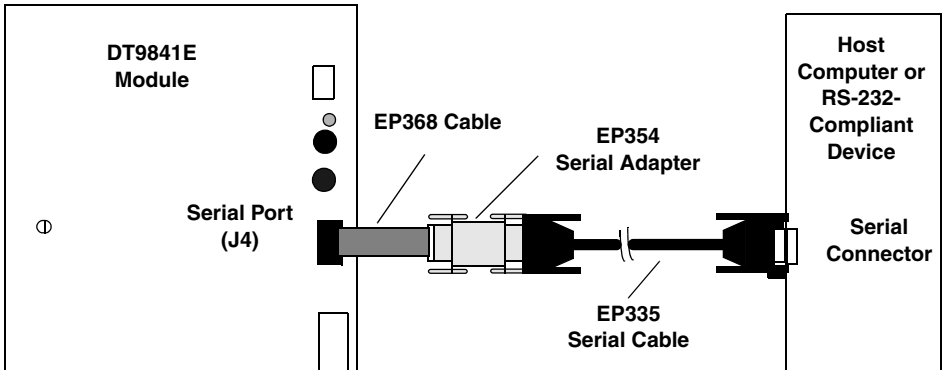


Figure 10: Connecting an RS-233-Complaint Device to the Serial Port (J4) of the DT9841E

For all other DT9840 Series modules, connect the male connector of the EP354 serial adapter directly into the serial connector (J4) of the DT9840 Series module, and secure it with the two retaining screws on the EP354 serial adapter, as shown in Figure 11.

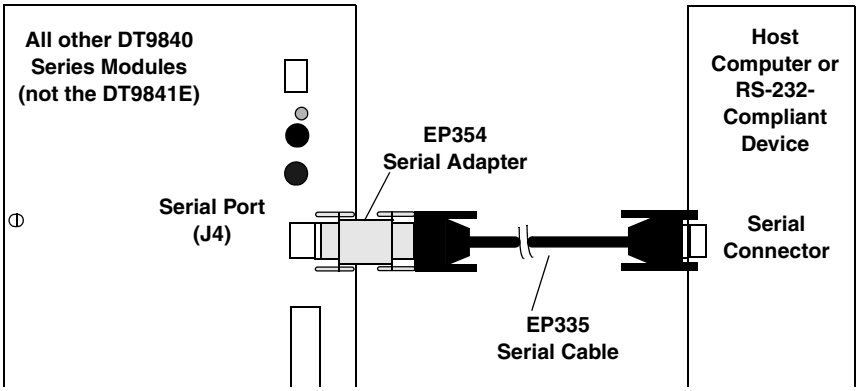


Figure 11: Connecting an RS-233-Complaint Device to the Serial Port (J4) of all other DT9840 Series Module (not the DT9841E)

2. Connect the female connector of the EP354 serial adapter to the male connector of the EP335 serial cable, and secure it with the two thumb screws on the EP335 cable.
3. Connect the female connector of the EP335 serial cable into the serial connector of your computer or other RS-232-compliant serial device, and secure it with the two thumb screws on the EP335 cable.
4. Set up HyperTerminal, described in the next section, or similar application to view the activity of the serial port.
5. Set up HyperTerminal, described on page 39, or similar application for printing information from the serial port.

You can now use the serial debugging functions in the DT9840 Series DSP Library to log information to the serial port, and view this information on the attached computer monitor. Refer to the *DT9840 Series DSP Library User's Manual* for more information on how to use the serial debugging functions.

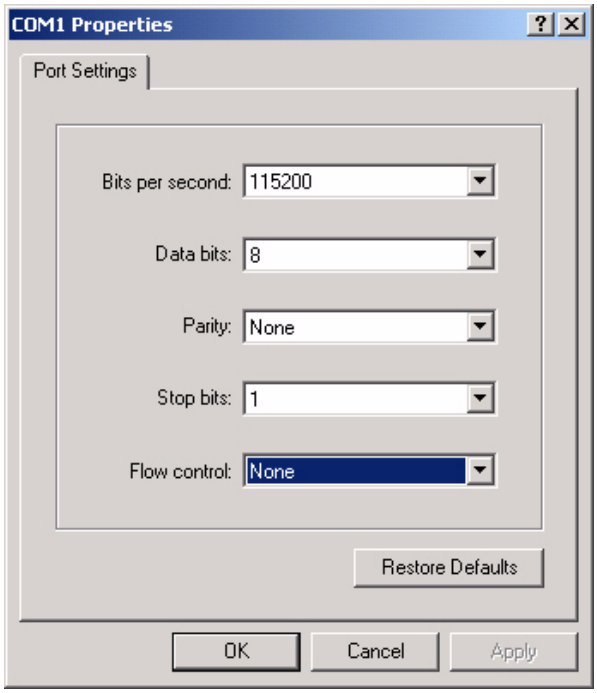
Setting Up HyperTerminal to View the Activity of the Serial Port

If you connected a computer to the serial port and want to use the standard Windows HyperTerminal application to view the activity on the serial port, do the following:

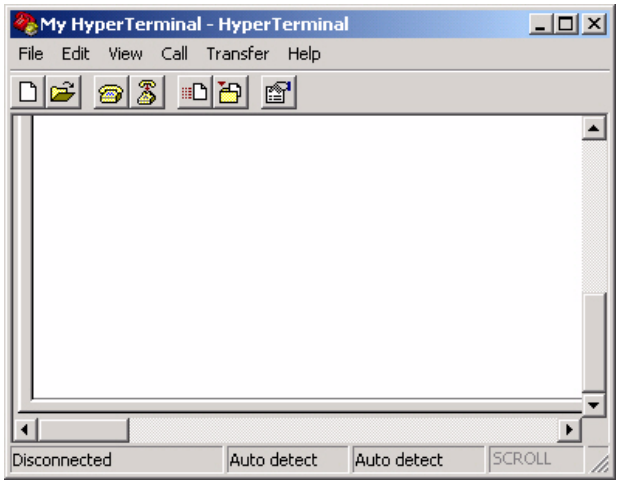
1. From your Windows Task Bar, click **Start\Programs\Accessories\Communications\HyperTerminal**.
   The HyperTerminal application opens and the following screen appears:

2. Enter a name for your connection, such as MyTerminal, and then click **OK**.
   The following screen appears:

3. Select the COM port to which you connected the EP335 cable.
   The following screen appears:



4. Configure the selected COM port to use 115200 baud, 8 data bits, no parity, 1 stop bit, and no flow control, and then click **OK**.
   The following screen appears:



If you want to print information from the serial port, continue with the next section.

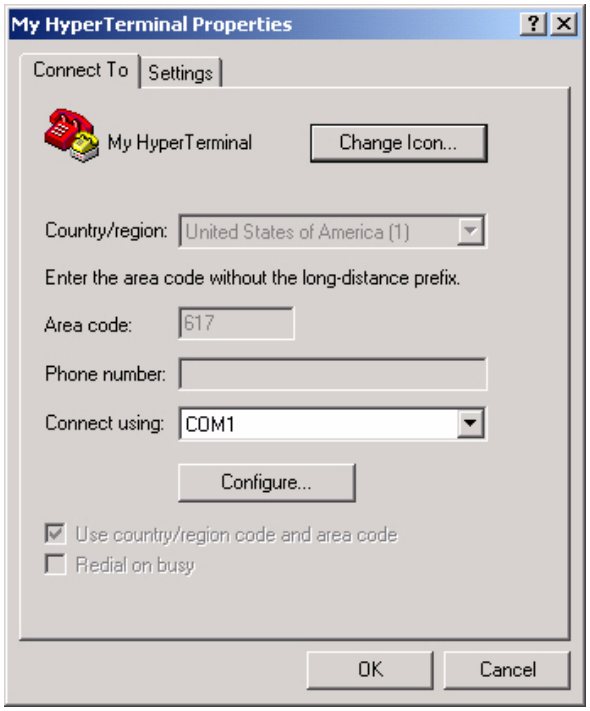
Setting up HyperTerminal to Print Information from the Serial Port

If you want to set up HyperTerminal to implicitly add line feeds to every carriage return (one way to ensure that lines print correctly when using HyperTerminal with the **DT_Printf** function), do the following:

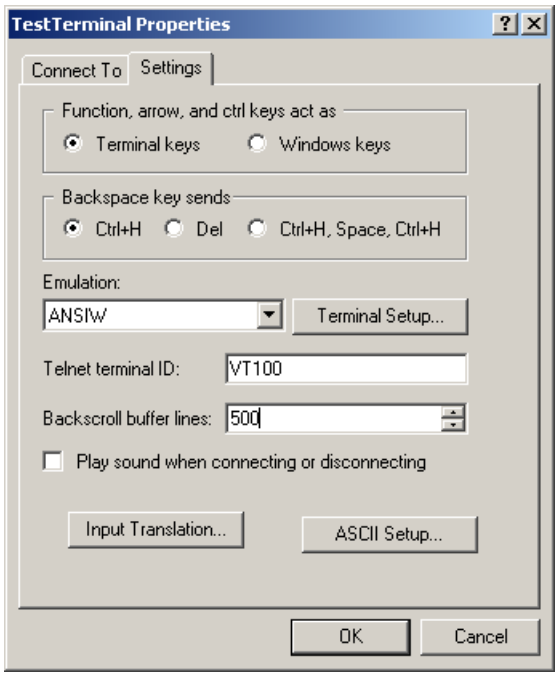
Note: With this configuration of HyperTerminal, use the *\r* format instead of the *\n* format with the **DT_Printf** function. Refer to the *DT9840 Series DSP Library User's Manual* for more information on this function.

---

1. Click **File**, and then click **Properties**.
   The following screen appears:

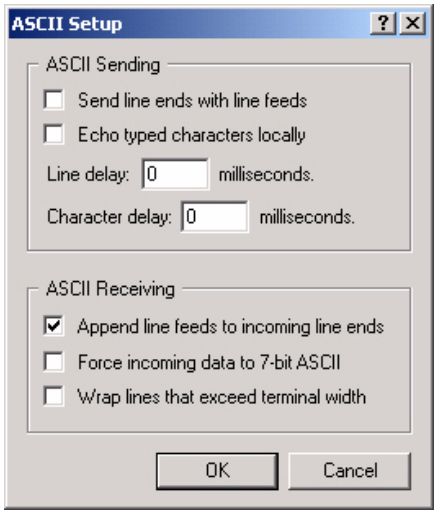


2. Click **Settings.**
   The following screen appears:



3. Configure the functions, arrows, and control keys to act as Terminal Keys, configure the backspace key to send Ctrl+H, specify ANSIW emulation, specify VT100 as the Telnet terminal ID, and specify 500 backscroll buffer lines.

4. Click **ASCII Setup**.
   The following screen appears:

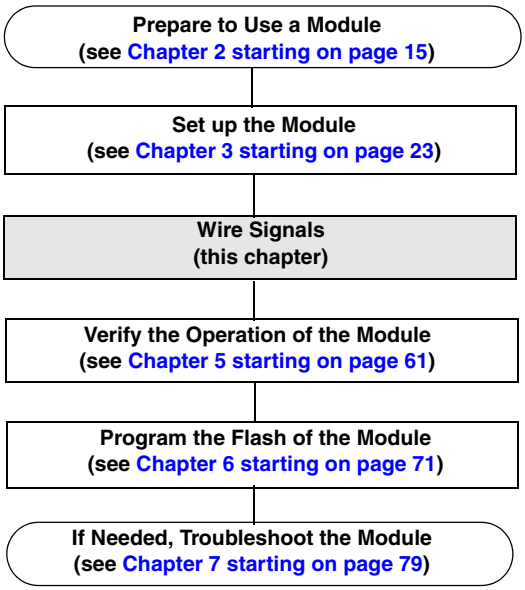


5. Check the box corresponding to Append line feeds to incoming line ends, uncheck all the other checkboxes, and then click **OK**.

4

Wiring Signals

Preparing to Wire Signals 43
Connecting Analog Input Signals 49
Connecting Analog Output Signals 54
Connecting Digital I/O Signals 55
Connecting Counter/Timer Signals 56


Prepare to Use a Module
(see Chapter 2 starting on page 15)
Set up the Module
(see Chapter 3 starting on page 23)
Wire Signals
(this chapter)
Verify the Operation of the Module
(see Chapter 5 starting on page 61)
Program the Flash of the Module
(see Chapter 6 starting on page 71)
If Needed, Troubleshoot the Module
(see Chapter 7 starting on page 79)

Preparing to Wire Signals

CAUTION:

To avoid electrostatic sensitivity, we recommend that you unplug your DT9840 Series module from the computer before wiring signals.

This section provides recommendations and information about wiring signals to the Sleek Box or to the EP358E accessory panel. If you are using the board-level version of the module, use this section for conceptual information, and refer to Appendix A starting on page 85 for connector pin assignments.

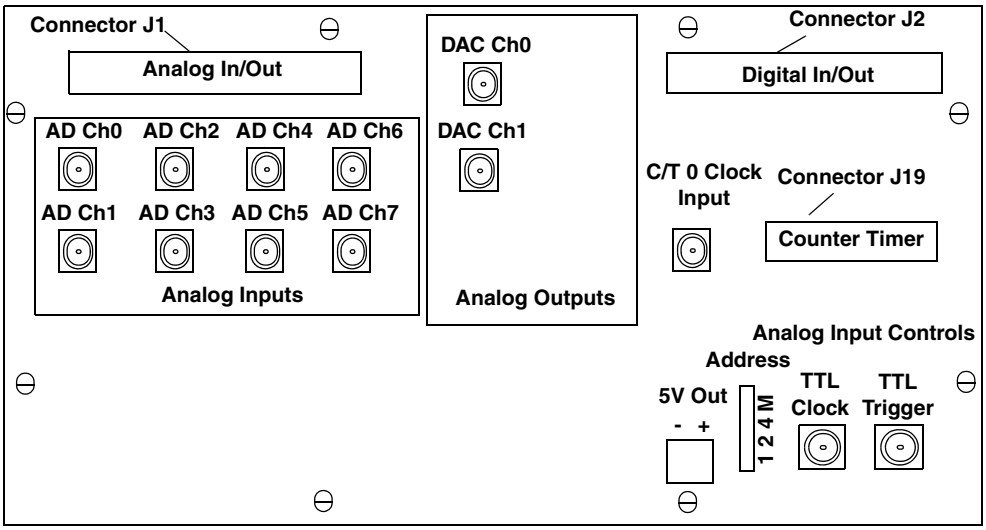
Wiring Recommendations

Keep the following recommendations in mind when wiring signals to a DT9840 Series module:

- Use individually shielded twisted-pair wire (size 14 to 26 AWG) when using a DT9840 Series module in highly noisy electrical environments.
- Separate power and signal lines by using physically different wiring paths or conduits.
- To avoid noise, do not locate the DT9840 Series module and cabling next to sources that produce high electromagnetic fields, such as large electric motors, power lines, solenoids, and electric arcs, unless the signals are enclosed in a mumetal shield.
- Prevent electrostatic discharge to the I/O while the DT9840 Series module is operational.
- Connect all unused analog input channels to analog ground.

Wiring to the Sleek Box

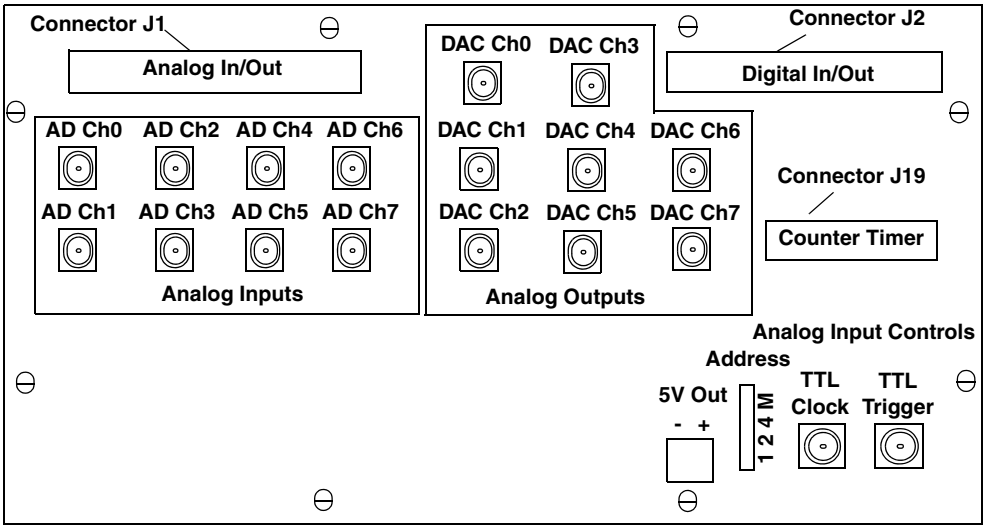
Figure 13 shows the connectors on the front panel of the DT9841-VIB-SB Sleek Box.



If you use the BNC labelled CT0 Clock as a tachometer input, ensure that you condition your signal to a TTL input, then configure the counter/timer for continuous measure mode.

Figure 12: I/O Connectors on the DT9841-VIB-SB Sleek Box

Figure 13 shows the connectors on the front panel of the Sleek Box for all other DT9840 Series modules (not including the DT9841-VIB-SB.



Notes:
The DT9841E only provides AD Ch 0 and AD Ch1.
DAC Ch2 through 7 are available on the DT9842/8 module only.

Figure 13: I/O Connectors on Other DT9840 Series Sleek Boxes (not including the DT9841-VIB-SB)

You can connect signals to the Sleek Box in the following ways:

- **BNC connectors** – BNCs labelled AD Ch0 to AD Ch7 are provided for attaching eight analog input signals. The BNCs are wired on the box to reflect the channel configuration (single-ended or differential) of your module.

  On the DT9841 and DT9842/2 Sleek Box, BNCs labelled DAC Ch0 and DAC Ch1 are provided for attaching two analog output signals. On the DT9842/8 Sleek Box, BNCs labelled DAC Ch0 to DAC Ch7 are provided for attaching eight analog output signals.

  The BNC labelled TTL Clock is provided for attaching an external clock signal. The BNC labelled TTL Trigger is provided for attaching an external trigger signal.

- **Analog In/Out Connector (J1)** – A 37-pin connector provided for attaching analog I/O signals. Refer to Table 3 on page 45 for more information on this connector.
- **Digital In/Out Connector (J2)** – A 37-pin connector provided for attaching digital I/O signals. Refer to Table 4 on page 46 for more information on this connector.
- **Counter Timer Connector (J19)** – A 25-pin connector provided for attaching counter/timer signals. Refer to Table 5 on page 47 for more information on this connector.
- **Screw terminal block** – A screw terminal block is provided for attaching an external +5 V power output signal.

Table 3: Analog In/Out Connector (J1) Pin Assignments

J1 Pin Assignment	Signal Description	J1 Pin Assignment	Signal Description
1	Analog Input 00	2	Analog Input 01
3	Analog Input 02	4	Analog Input 03
5	Analog Input 04	6	Analog Input 05
7	Analog Input 06	8	Analog Input 07
9	Analog Common	10	Analog Output 00
11	Analog Output 01	12	Analog Output 02[a]
13	Analog Output 03[a]	14	Analog Output 04[a]
15	Analog Output 05[a]	16	Analog Output 06[a]
17	Analog Output 07[a]	18	Analog Common
19	Reserved	20	Analog Input 00 Return[b]
21	Analog Input 01 Return[b]	22	Analog Input 02 Return[b]
23	Analog Input 03 Return[b]	24	Analog Input 04 Return[b]
25	Analog Input 05 Return[b]	26	Analog Input 06 Return[b]
27	Analog Input 07 Return[b]	28	Analog Common
29	Analog Output 00 Return	30	Analog Output 01 Return
31	Analog Output 02 Return[a]	32	Analog Output 03 Return[a]

Table 3: Analog In/Out Connector (J1) Pin Assignments (cont.)

J1 Pin Assignment	Signal Description	J1 Pin Assignment	Signal Description
33	Analog Output 04 Return[a]	34	Analog Output 05 Return[a]
35	Analog Output 06 Return[a]	36	Analog Output 07 Return[a]
37	Analog Common		

a. Available on the DT9842/8 module only. For all other modules, these are reserved.
b. For the DT9841-VIB, DT9842/2, and DT9842/8, which have single-ended analog inputs, these signals are analog grounds.

Table 4: Digital In/Out Connector (J2) Pin Assignments

J2 Pin Assignment	Signal Description	J2 Pin Assignment	Signal Description
1	Digital In/Out 3, Port 0	2	Digital In/Out 2, Port 0
3	Digital In/Out 1, Port 0	4	Digital In/Out 0, Port 0
5	Digital In/Out 3, Port 1	6	Digital In/Out 2, Port 1
7	Digital In/Out 1, Port 1	8	Digital In/Out 0, Port 1
9	Digital In/Out 3, Port 2[a]/TINP1[b]	10	Digital In/Out 2, Port 2[a]/Encoder 2 Clr[b]
11	Digital In/Out 1, Port 2[a]/Encoder 1 Clr[b]	12	Digital In/Out 0, Port 2[a]/Encoder 0 Clr[b]
13	Isolated Digital Ground	14	Isolated Digital Ground
15	Isolated Digital Ground	16	Isolated Digital Ground
17	Isolated Digital Ground	18	Isolated Digital Ground
19	Reserved	20	Digital In/Out 7, Port 0
21	Digital In/Out 6, Port 0	22	Digital In/Out 5, Port 0
23	Digital In/Out 4, Port 0	24	Digital In/Out 7, Port 1
25	Digital In/Out 6, Port 1	26	Digital In/Out 5, Port 1
27	Digital In/Out 4, Port 1	28	Digital In/Out 7, Port 2[a]
29	Digital In/Out 6, Port 2[a]	30	Digital In/Out 5, Port 2[a]
31	Digital In/Out 4, Port 2[a]	32	Isolated Digital Ground
33	Isolated Digital Ground	34	Isolated Digital Ground
35	Isolated Digital Ground	36	Isolated Digital Ground
37	Isolated Digital Ground		

a. The DT9841-VIB does not provide digital I/O port 2; these signals are reserved.
b. Currently, not implemented.

Table 5: Counter/Timer Connector (J19) Pin Assignments

J13 Pin Assignment	Signal Description	J13 Pin Assignment	Signal Description
1	User Counter Output 2	2	User Clock Input 2/Encoder A2[a]
3	User Counter Output 1	4	User Clock Input 1/Encoder A1[a]
5	User Counter Output 0	6	User Clock Input 0/Encoder A0[a]
7	Isolated Digital Ground	8	Isolated Digital Ground
9	Isolated Digital Ground	10	Isolated Digital Ground
11	Isolated Digital Ground	12	Isolated Digital Ground
13	Reserved	14	External Gate 2/Encoder B2[a]
15	Isolated Digital Ground	16	External Gate 1/Encoder B1[a]
17	Isolated Digital Ground	18	External Gate 0/Encoder B0[a]
19	Isolated Digital Ground	20	Isolated Digital Ground
21	Isolated Digital Ground	22	Isolated Digital Ground
23	Isolated Digital Ground	24	Isolated Digital Ground
25	Isolated Digital Ground		

a. Currently, the encoder signals are not implemented.

Wiring to the EP358E Accessory Panel

The optional EP358E accessory panel is provided for the DT9841E module, and comes with the DT9841E-DK developer's kit. Refer to page 47 for more information on connecting the accessory panel to the DT9841E. Figure 14 shows the connectors on the front side of the EP358E accessory panel.

You can connect signals to the EP358E accessory panel in the following ways:

- **BNC connectors** – BNCs labelled CH0 and CH1 are provided for attaching two differential analog input signals.

  BNCs labelled DAC0 and DAC1 are provided for attaching two analog output signals.
- **Analog In/Out Connector (J1)** – A 37-pin connector provided for attaching analog I/O signals. Refer to Table 3 on page 45 for more information on this connector.
- **Digital In/Out Connector (J2)** – A 37-pin connector provided for attaching digital I/O signals. Refer to Table 4 on page 46 for more information on this connector.
- **Counter Timer Connector (J19)** – A 25-pin connector provided for attaching counter/timer signals. Refer to Table 5 on page 47 for more information on this connector.

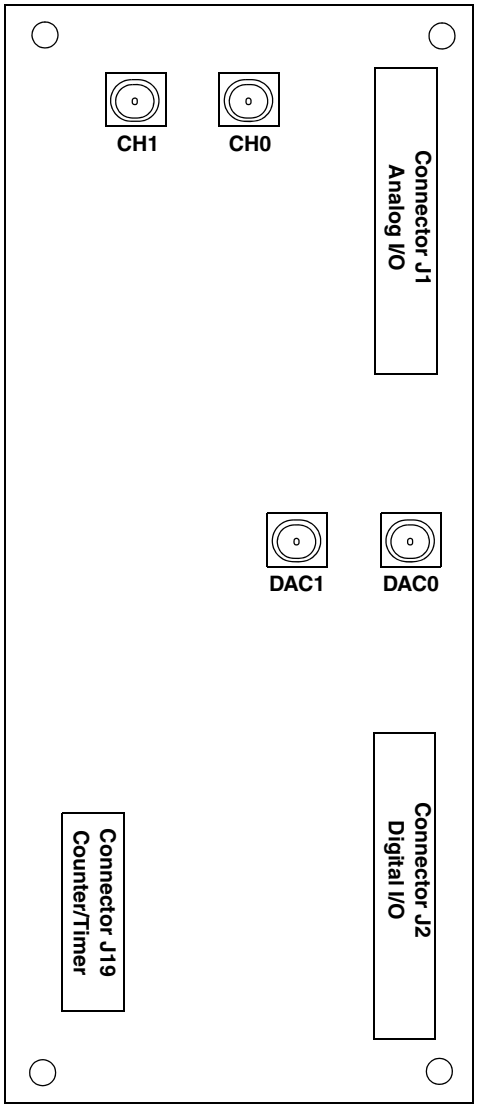


Figure 14: I/O Connectors on the Front of the EP358E Accessory Panel

Connecting Analog Input Signals

All DT9840 Series modules support analog input channels to which you can connect voltage and current loop inputs. The DT9841 module supports 8 differential analog inputs. The DT9841-VIB module supports 8 single-ended channels and also allows connection to IEPE inputs. The DT9841E module supports 2 differential analog inputs. The DT9842/2 and DT9842/8 modules support 8 single-ended analog inputs.

The following subsections describe how to connect differential analog inputs to the DT9841 and DT9841E modules, and single-ended analog inputs to the DT9841-VIB, DT9842/2, and DT9842/8.

Connecting Differential Analog Input Signals to the DT9841 or DT9841E

Figure 15 shows how to connect differential voltage inputs (channels 0 and 1, in this case) to the BNCs on the DT9841 Sleek Box.

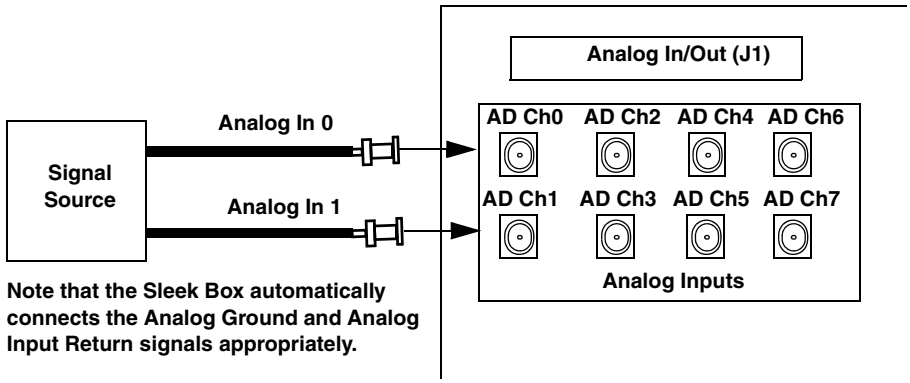


Figure 15: Connecting Differential Inputs to the BNCs on the DT9841 Sleek Box

If you are using a DT9841E, Figure 15 shows how to connect differential voltage inputs (channels 0 and 1, in this case) to the BNCs on the EP358E accessory panel.

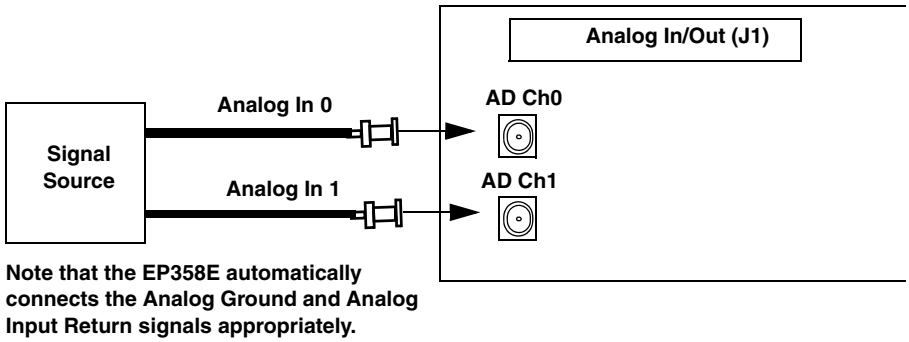

Analog In/Out (J1)
Signal Source
Analog In 0
Analog In 1
AD Ch0
AD Ch1
Note that the EP358E automatically connects the Analog Ground and Analog Input Return signals appropriately.

Figure 16: Connecting Differential Inputs to the BNCs on the EP358E Accessory Panel

If you'd rather, you can also connect differential inputs to the Analog In/Out (J1) connector on the DT9841 Sleek Box or EP358E accessory panel. Figure 17 illustrates how to connect a floating signal source to the Analog In/Out (J1) connector. (A floating signal source is a voltage source that has no connection with earth ground.)

Note: For floating signal sources, we recommend that you provide a bias return path for the differential channels by adding 1 kΩ of termination resistance from the low side of the channel to isolated analog ground. You do this in software when you set up the A/D operation.

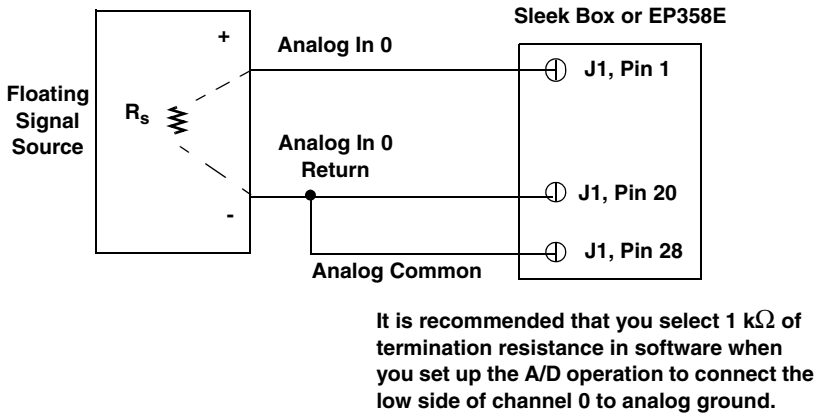

Sleek Box or EP358E
+
Analog In 0
J1, Pin 1
Floating Signal Source
Rs
Analog In 0 Return
J1, Pin 20
-
J1, Pin 28
Analog Common
It is recommended that you select 1 kΩ of termination resistance in software when you set up the A/D operation to connect the low side of channel 0 to analog ground.

Figure 17: Connecting a Floating Signal Source to the Analog In/Out (J1) Connector on the DT9841 Sleek Box or EP358E Accessory Panel

Figure 18 illustrates how to connect a nonfloating signal source to the Analog In/Out (J1) connector on the DT9841 Sleek Box or EP358E accessory panel. In the case of nonfloating signal sources, the signal source itself provides the bias return path; therefore, you do not need to provide bias return resistance through software.

R_s is the signal source resistance while R_v is the resistance required to balance the bridge. Note that the negative side of the bridge supply must be returned to analog ground.

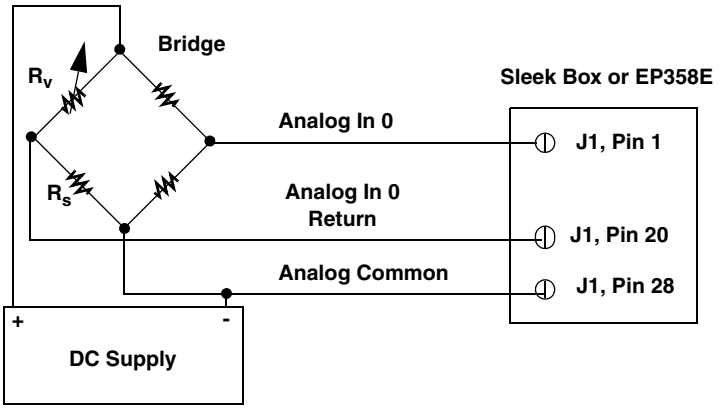


Figure 18: Connecting a Nonfloating Signal Source to the Analog In/Out (J1) Connector on the DT9841 Sleek Box or EP358E Accessory Panel

Note that since they measure the difference between the signals at the high (+) and low (–) inputs, differential connections usually cancel any common-mode voltages, leaving only the signal. However, if you are using a grounded signal source and ground loop problems arise, connect the differential signals to the Analog In/Out (J1) connector on the DT9841 Sleek Box or EP358E accessory panel, as shown in Figure 19.

Ensure that the low side of the signal (–) is connected to ground at the signal source, not at the Sleek Box or EP358E, and do not tie the two grounds together.

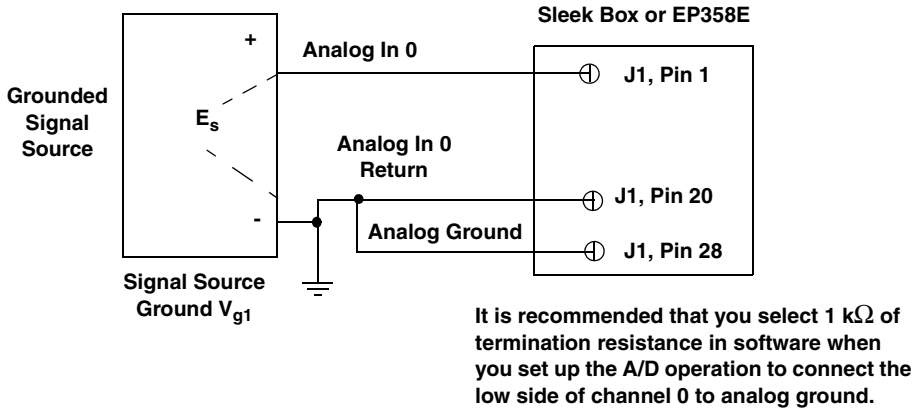

Sleek Box or EP358E
Grounded Signal Source
+
E_s
-
Analog In 0
Analog In 0 Return
Analog Ground
J1, Pin 1
J1, Pin 20
J1, Pin 28
Signal Source Ground V_{g1}
It is recommended that you select 1 kΩ of termination resistance in software when you set up the A/D operation to connect the low side of channel 0 to analog ground.

Figure 19: Connecting a Grounded Signal Source to the Analog In/Out (J1) Connector on the DT9841 Sleek Box or EP358E Accessory Panel

Figure 20 shows how to connect a current loop input to the Analog In/Out (J1) connector on the DT9841 Sleek Box or EP358E accessory panel.

Note: If you are using current loop inputs, set up the software so that bias return resistance is used. For more information, refer to page 31.

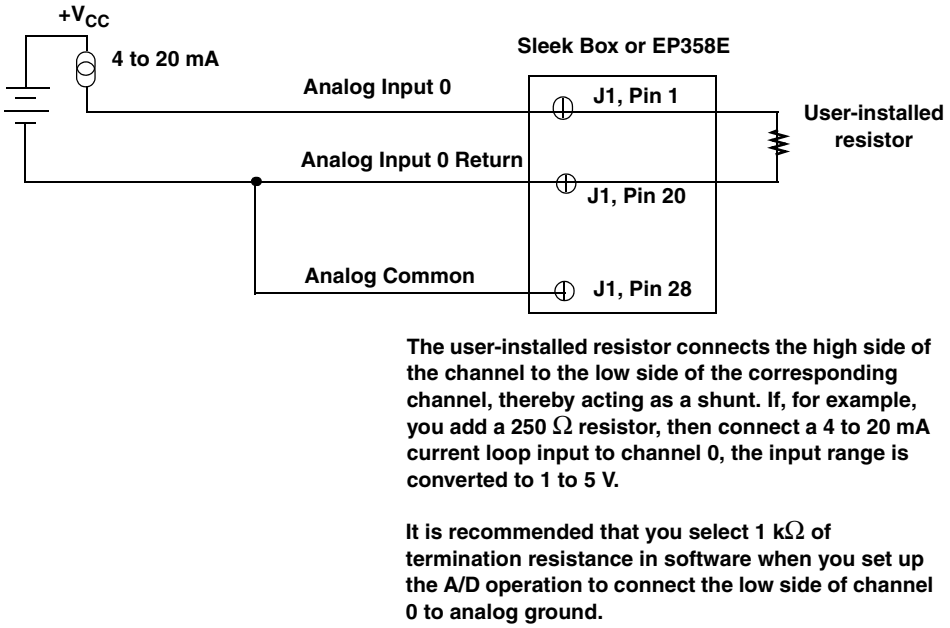

$+V_{CC}$
4 to 20 mA
Sleek Box or EP358E
Analog Input 0
Analog Input 0 Return
Analog Common
J1, Pin 1
J1, Pin 20
J1, Pin 28
User-installed resistor
The user-installed resistor connects the high side of the channel to the low side of the corresponding channel, thereby acting as a shunt. If, for example, you add a 250 Ω resistor, then connect a 4 to 20 mA current loop input to channel 0, the input range is converted to 1 to 5 V.
It is recommended that you select 1 kΩ of termination resistance in software when you set up the A/D operation to connect the low side of channel 0 to analog ground.

Figure 20: Connecting Current Inputs to the Analog In/Out (J1) Connector on the DT9841 Sleek Box or EP358E Accessory Panel

Connecting Single-Ended Voltage Inputs to the DT9841-VIB, DT9842/2, or DT9842/8 Sleek Box

Note: If you are using single-ended inputs, we recommend that you set up the software so that termination resistance is not used for the A/D subsystem.

Figure 15 shows how to connect single-ended voltage inputs (channels 0 and 1, in this case) to the BNCs on the DT9841-VIB, DT9842/2, or DT9842/8 Sleek Box.

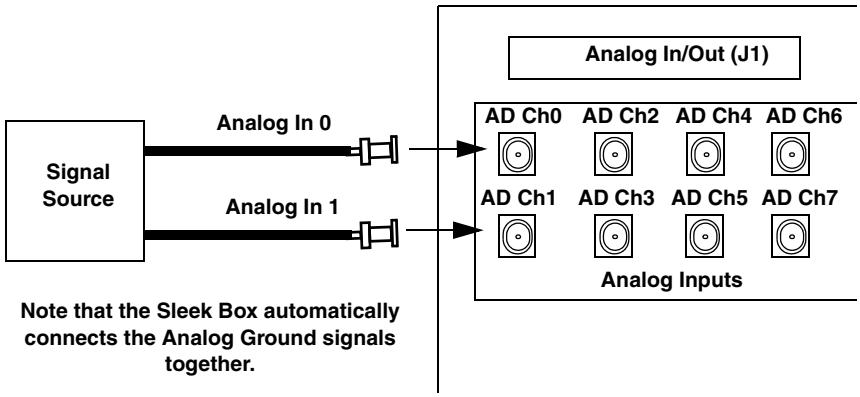


Figure 21: Connecting Single-Ended Inputs to the BNCs on the DT9841-VIB, DT9842/2, or DT9842/8 Sleek Box

If you'd rather, you can also connect single-ended inputs to the Analog In/Out (J1) connector on the DT9841-VIB, DT9842/2, or DT9842/8 Sleek Box, as shown in Figure 22.

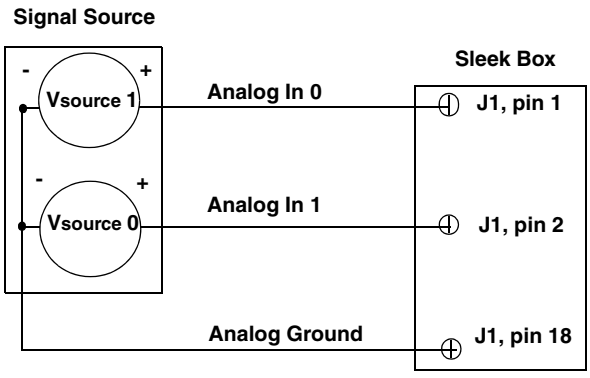


Figure 22: Connecting Single-Ended Inputs to the Analog In/Out (J1) Connector on the DT9841-VIB, DT9842/2, or DT9842/8 Sleek Box

Connecting Analog Output Signals

DT9841, DT9841E, DT9841-VIB, and DT9842/2 modules support two analog output channels. The DT9842/8 module supports eight analog output channels.

Figure 23 shows how to connect an analog output voltage signal (channel 0, in this case) to the BNCs of the Sleek Box.

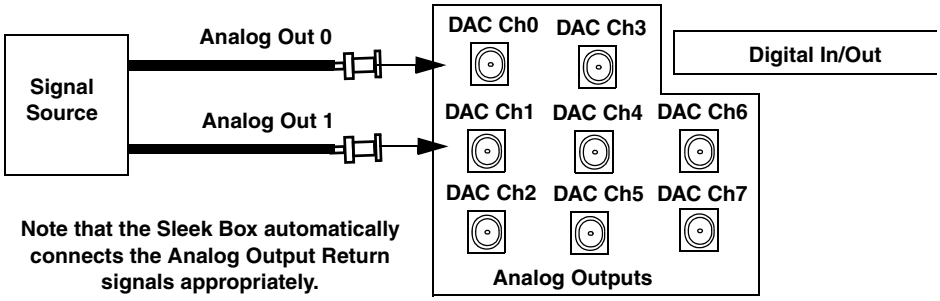


Figure 23: Connecting Analog Output Signals to the BNCs on the Sleek Box

If you are using a DT9841E, Figure 24 shows how to connect an analog output voltage signal (channel 0, in this case) to the BNCs on the EP358E accessory panel.

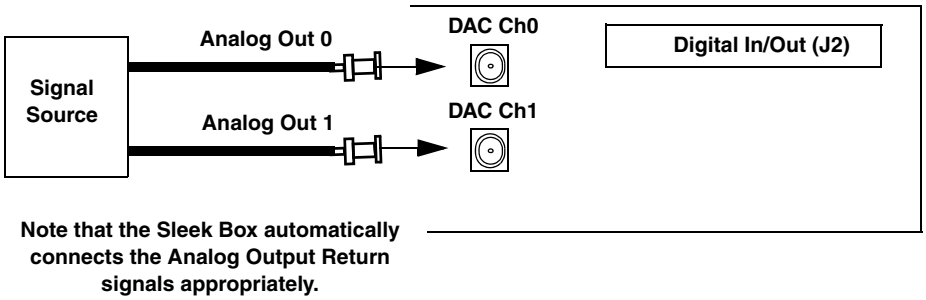

Signal Source
Analog Out 0
Analog Out 1
DAC Ch0
DAC Ch1
Digital In/Out (J2)
Note that the Sleek Box automatically connects the Analog Output Return signals appropriately.

Figure 24: Connecting Analog Output Signals to the BNCs on the EP358E Accessory Panel

If you'd rather, you can also connect analog outputs to the Analog In/Out (J1) connector on the Sleek Box or EP358E accessory panel, as shown in Figure 25.

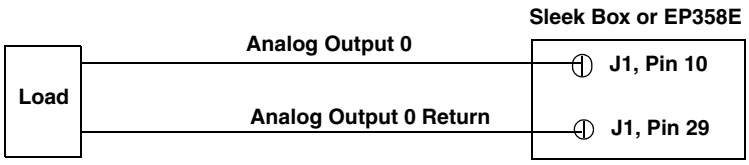


Figure 25: Connecting Analog Outputs to the Analog In/Out (J1) Connector on the Sleek Box or EP358E Accessory Panel

Connecting Digital I/O Signals

The DT9841-VIB supports two 8-bit ports (ports 0 and 1) that you can program for digital input or digital output. All other DT9840 Series modules support three 8-bit ports (ports 0, 1, and 2) that you can program for digital input or digital output. Port 0, if configured for digital input, supports interrupt-on-change on all eight bits.

Figure 26 shows how to connect digital input signals to the Digital In/Out (J2) connector on the Sleek Box or EP358E accessory panel.

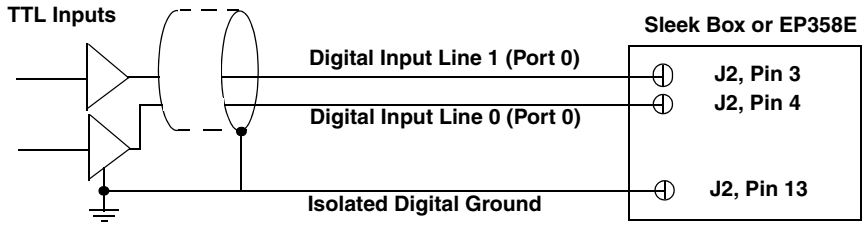


Figure 26: Connecting Digital Inputs to the Digital In/Out (J2) Connector on the Sleek Box

Figure 27 shows how to connect digital output signals to the Digital In/Out (J2) connector on the Sleek Box or EP358E accessory panel.

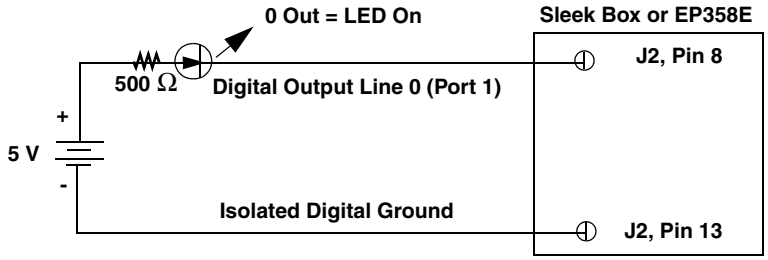


Figure 27: Connecting Digital Outputs to the Digital In/Out (J2) Connector on the Sleek Box

Connecting Counter/Timer Signals

The DT9840 Series module provides three 32-bit user counter/timer channels that you can use to perform the following operations:

- Event counting and up/down counting
- Measurements, including frequency, period, and pulse width measurements
- Pulse output operations, including rate generation, one-shot, and repetitive one-shot operations

Note: For the DT9841-VIB module, the counter/timer 0 clock input signal is also brought out to a BNC connector on the front panel (CT0 Clock). If you want to use this input as a tachometer input, ensure that you condition your signal to a TTL input, then configure your counter/timer operation for continuous measure mode.

This section describes how to connect counter/timer signals to perform these operations. Refer to the *DT9840 Series User's Manual* for more information on using the counter/timers.

Connecting Signals for Event Counting and Up/Down Counting Operations

In standard event counting operations, clock pulses are counted while the gate signal is active. In up/down counting operations, the counter increments when the gate signal is active and decrements when the gate signal is inactive; an external gate signal is required.

Figure 28 shows an example of how to connect signals to the Counter/Timer (J19) connector on the Sleek Box or EP358E accessory panel for an event counting or up/down counting operation when using an externally-supplied hardware gate.

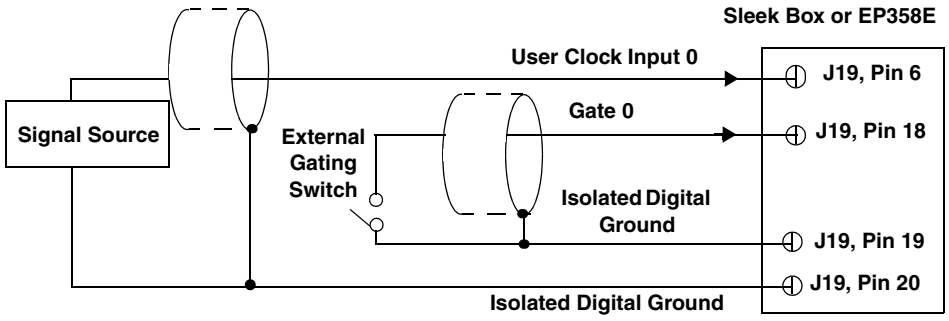


Figure 28: Connecting Signals for an Event Counting or Up/Down Counting Operation Using an External Gate

Figure 29 shows an example of how to connect signals to the Counter/Timer (J19) connector on the Sleek Box or EP358E accessory panel for an event counting operation using a software gate (no external gate connection is required).

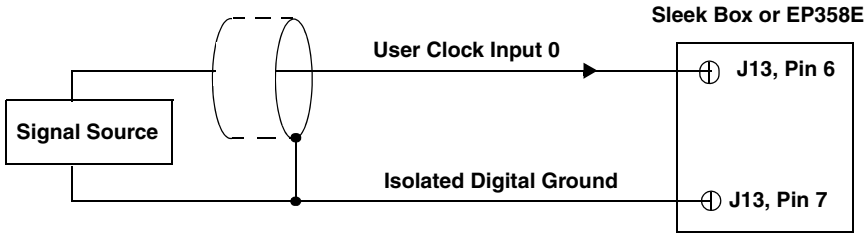


Figure 29: Connecting Signals for an Event Counting Operation Using a Software Gate

Figure 30 shows an example of connecting signals to the Counter/Timer (J19) connector on the Sleek Box or EP358E accessory panel to cascade two counters for an event counting operation.

Note: You can also internally cascade counters using software; if you internally cascade the counters, you do not need to make the external cascading connections.

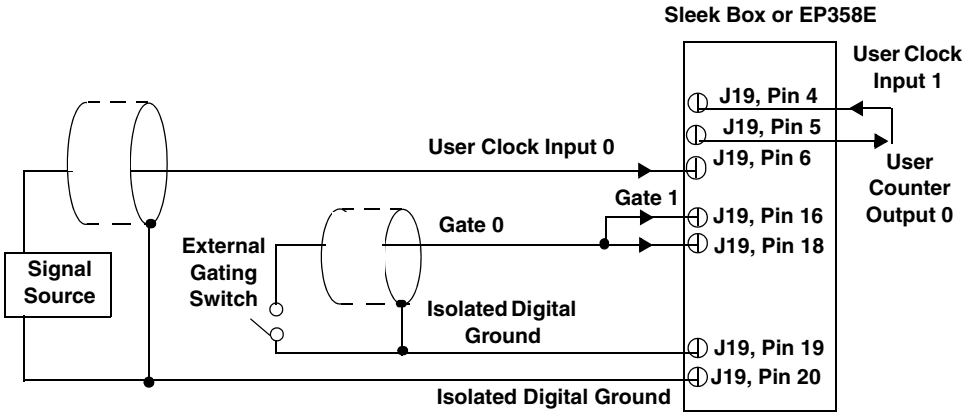


Figure 30: Cascading Counters for an Event Counting Operation

Connecting Signals for a Measurement Operation

In measure mode, you do not specify the clock input source or gate type in software; the physical input connection and the specified edge type determine the signal that is measured.

Figure 31 shows an example of connecting signals to the Counter/Timer (J19) connector on the Sleek Box or EP358E accessory panel for a frequency measurement operation. In this example, the signal whose frequency you want to measure is connected to the clock input pin of counter/timer 0.

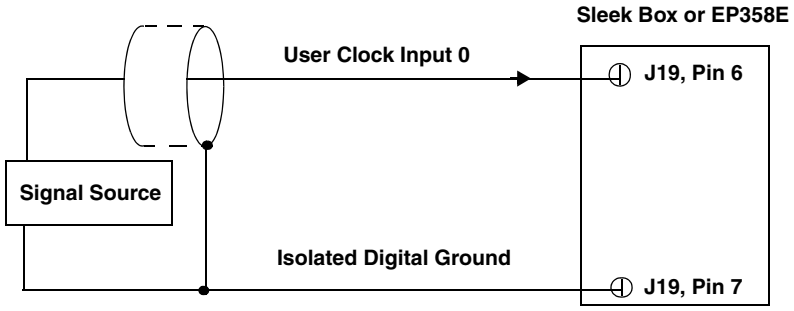


Figure 31: Connecting Signals for a Frequency Measurement Operation

Counter/timer 0 starts counting when it detects the first rising edge of the signal connected to the clock input pin and stops counting when it detects the first falling edge of the signal connected to the clock input pin (these edges are specified in software). The software returns the count.

You can calculate the frequency of your signal using this count, as follows:

Frequency = 18 MHz/Number of *Counts*

Connecting Signals for Pulse Output Operations

Figure 32 shows an example of connecting signals to the Counter/Timer (J19) connector on the Sleek Box or EP358E accessory panel for a continuous pulse operation (rate generation mode). This example uses an external gate.

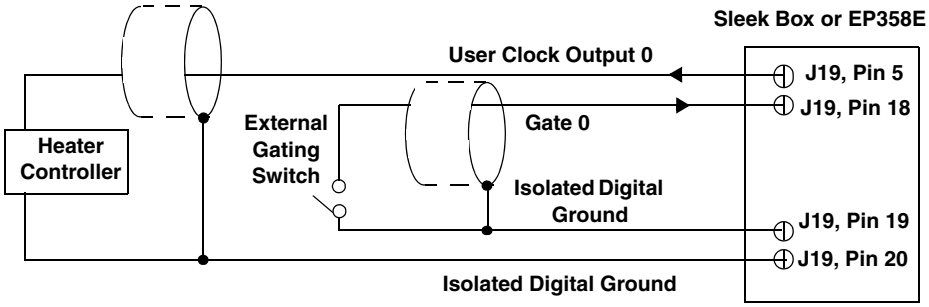


Figure 32: Connecting Signals for a Pulse Output Operation

Figure 33 shows an example of connecting signals to the Counter/Timer (J19) connector on the Sleek Box or EP358E accessory panel to externally cascade two counters for a rate generation operation. In this example, the gate to counter/timer 1 is logic high.

Note: You can also cascade counters internally using software; if you internally cascade the counters, you do not need to make the external cascading connections.

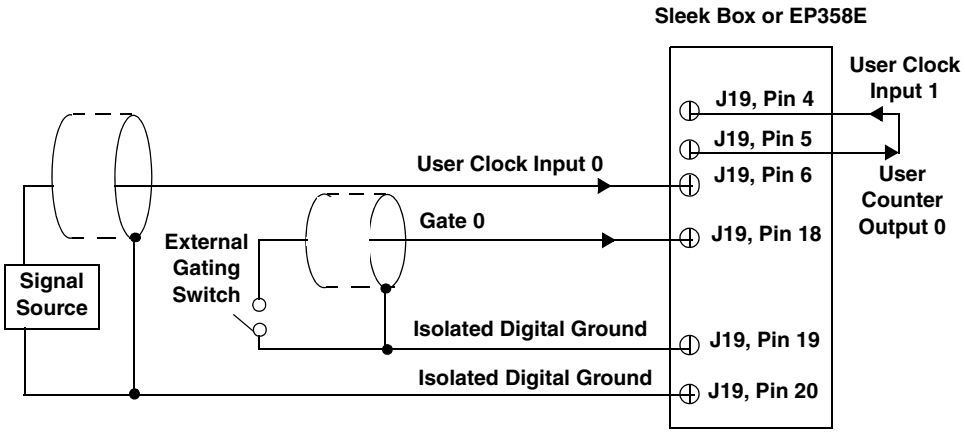


Figure 33: Cascading Counters for a Rate Generation Operation

Figure 34 shows an example of connecting signals to the Counter/Timer (J19) connector on the Sleek Box or EP358E accessory panel to cascade two counters for a one-shot operation. In this example, the gate for counter/timer 0 is logic high.

Note: You can also internally cascade counters using software; if you internally cascade the counters, you do not need to make the external cascading connections.

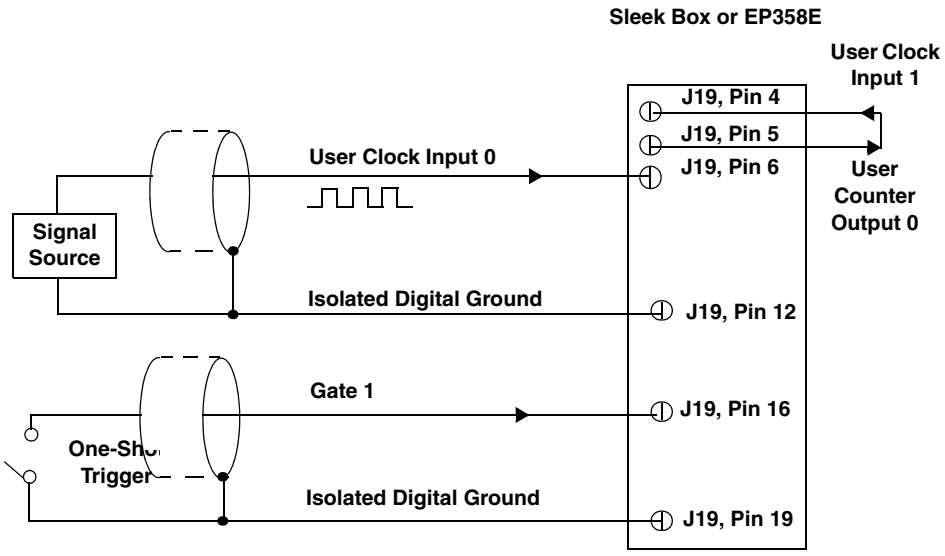
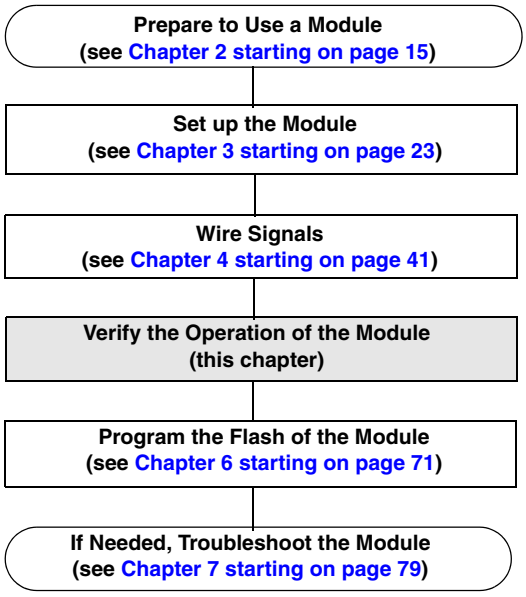


Figure 34: Cascading Counters for a One-Shot or Repetitive One-Shot Operation

Verifying the Operation of a Module

Running the DT9840 Series Download Utility 63
Performing Quick LED Tests 65
Downloading and Running a DSP Program 67
Performing Memory Tests 69


Prepare to Use a Module
(see Chapter 2 starting on page 15)
Set up the Module
(see Chapter 3 starting on page 23)
Wire Signals
(see Chapter 4 starting on page 41)
Verify the Operation of the Module
(this chapter)
Program the Flash of the Module
(see Chapter 6 starting on page 71)
If Needed, Troubleshoot the Module
(see Chapter 7 starting on page 79)

To verify the operation of your module, use the DT9840 Series Download Utility.

The DT9840 Series Download Utility provided on the DT9840 Series Software CD allows you to verify that the DT9840 Series module is operating properly. Using this utility, you can perform quick LED and memory tests on a DT9840 Series module, and download a DSP program to the SDRAM of a DT9840 Series module.

Running the DT9840 Series Download Utility

To run the DT9840 Series Download Utility, do the following:

1. From Start\Programs\Data Translation, Inc\DT9840 Series, click **DT9840 Series Download Utility**.
   The screen shown in Figure 35 appears.

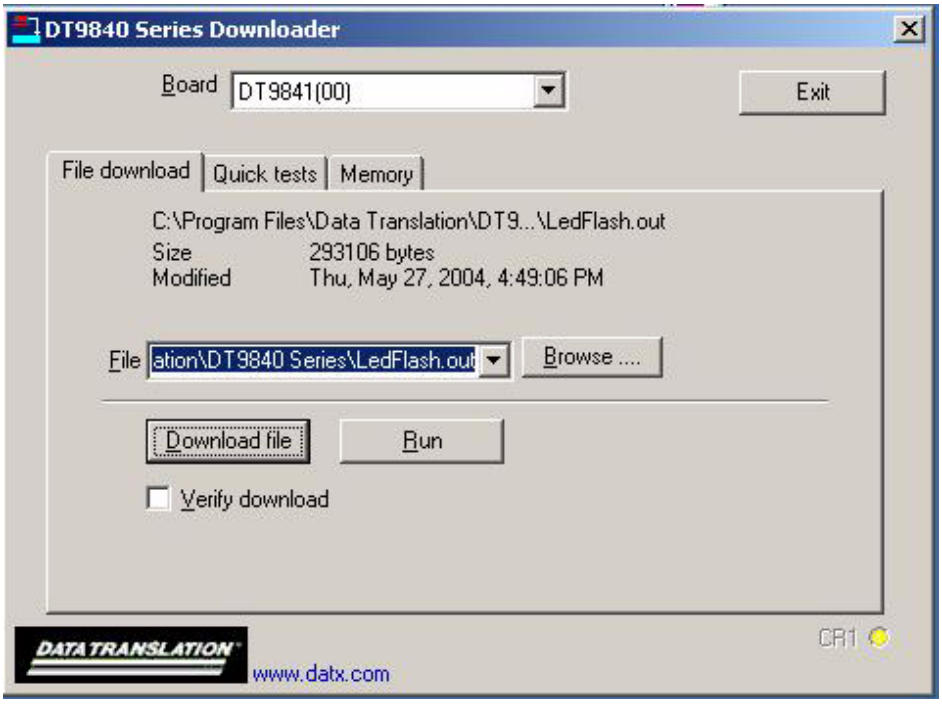


Figure 35: DT9840 Series Download Utility

2. From the Board drop-down list, select the DT9840 Series module to which you want to download a file or on which you want to perform diagnostics tests.
3. Click the **Quick test** tab, described on page 65, to turn the debug LEDs on and off. This test verifies basic communication with a DT9840 Series module.

Note: Debug LEDs are not provided on the DT9841E; therefore, skip this step if you are using a DT9841E module.

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4. Click the **File download** tab, described on page 67, and download and run the LEDFlash.out DSP program that is provided on the DT9840 Series Software CD with the module. This program flashes the LEDs on the DT9840 Series module. This step demonstrates host to DSP communication.

Note: Debug LEDs are not provided on the DT9841E; therefore, do not download the LEDFlash.out program if you are using the DT9841E module.

5. Click the **Memory** tab, described on page 69, if you want to debug your DSP application by reading from or writing to various memory locations on the DSP.
6. When you are finished with this utility, click **Exit**.

Performing Quick LED Tests

Note: Debug LEDs are not provided on the DT9841E; therefore, skip this procedure if you are using a DT9841E module.

Quick LED tests allow you to verify that the DT9840 Series Device Driver and USB connection to the module are installed and working properly. You can perform quick LED tests at any time after the DT9840 Series software has been installed. A DSP program does not have to be running.

When the **Quick tests** tab is selected, the screen shown in Figure 36 appears.

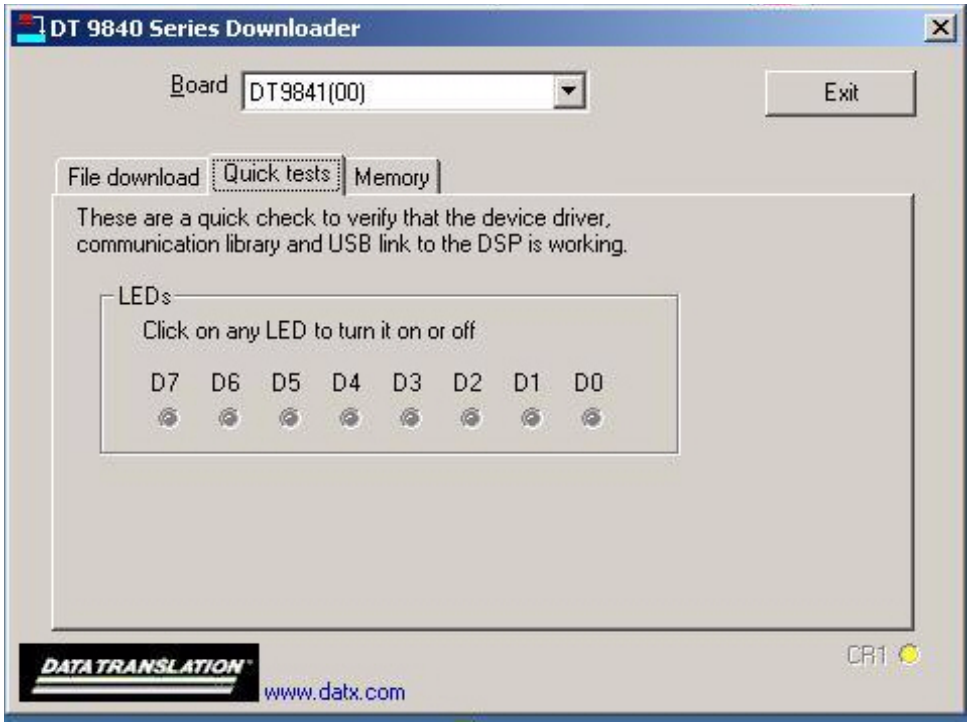

DT 9840 Series Downloader
Board
DT9841(00)
Exit
File download
Quick tests
Memory
These are a quick check to verify that the device driver, communication library and USB link to the DSP is working.
LEDs
Click on any LED to turn it on or off
D7 D6 D5 D4 D3 D2 D1 D0
DATA TRANSLATION
www.datx.com
CR1

Figure 36: Quick Tests Tab

Click the D0 to D7 radio buttons that correspond to the debug LEDs (CR7 to CR14) that you want to turn on. Refer to Figure 1 on page 10 for the location of these LEDs.

Note: These LEDs are accessible through a removable side panel on the Sleek Box.

If the DT9840 Series module is working properly, all the debug LEDs that were selected should light on the module, while all the LEDs that were unselected should not light.

Note: If you previously downloaded and ran a DSP program on the DT9840 Series module, and an error was detected, LED CR1, shown in Figure 1 on page 10, stops flashing and all the debug LEDs turn on.

Downloading and Running a DSP Program

The **File download** tab allows you to download a compiled DSP program to the SDRAM of a DT9840 Series module, and run that program. You create a DSP program using Code Composer from Texas Instruments. The DSP program must conform to the COFF (Common Object File Format) format, which has a .OUT extension.

When the **File download** tab is selected, the screen shown in Figure 37 appears.

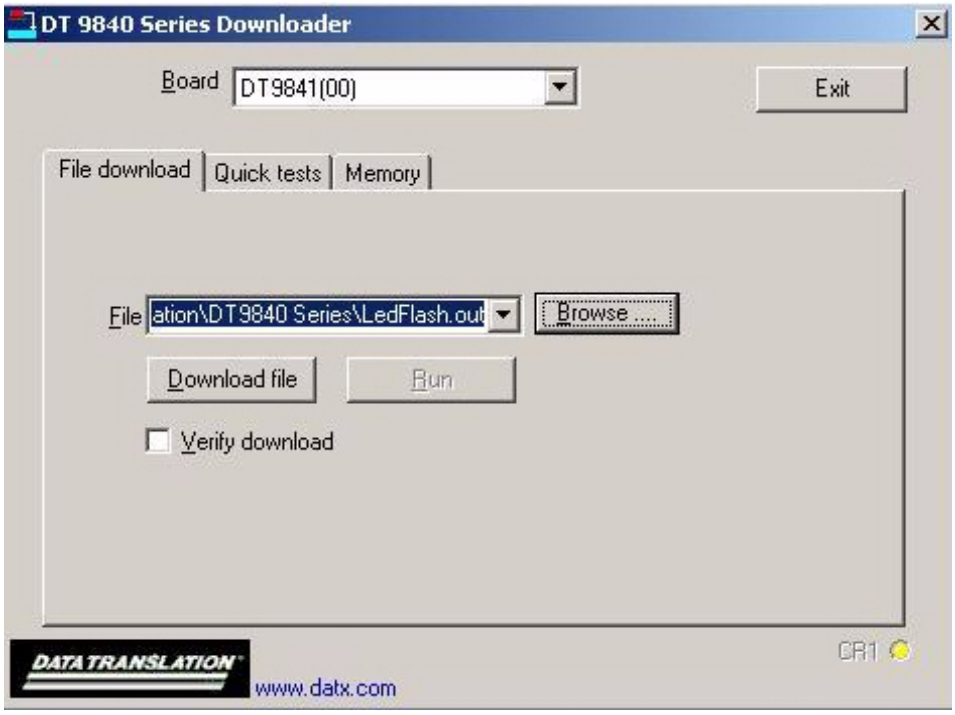


Figure 37: File Download Tab

To download a DSP program to the SDRAM of a DT9840 Series module and run that program, do the following:

1. Enter the path of the COFF file that you want to download to the DSP of the module in the File text box, or use the Browse button to locate the COFF file. You can use the precompiled DSP program called LEDFlash.OUT that is provided on the DT9840 Series Software CD, if you wish.

Note: Debug LEDs are not provided on the DT9841E; therefore, do not download the LEDFlash.out program if you are using the DT9841E module.

---

2. If you want each segment that is downloaded to the DT9840 Series module to be read back from DSP memory and verified, click the **Verify download** checkbox. Clicking this checkbox slows down the download significantly, but ensures that any errors caused by loading the DSP program into non-existent memory ranges are caught.

   If you do not want to verify the download operation, clear the checkbox.

3. Click **Download file** to download the file to the SDRAM of the DT9840 Series module.

4. Once the file has been downloaded, click **Run** to run the downloaded file.
   If you downloaded and ran the LEDFlash.OUT program, the debug LEDs on the module flash. Refer to Figure 1 on page 10 *for the location of these LEDs.*

Once a DT9840 Series DSP program is running successfully, LED CR1 (shown in Figure 1 on page 10) turns red when the firmware is loaded and started, then turns orange when the Windows driver is loaded and started. When you download and run a DSP program, this LED flashes green and orange. If an error occurs, this LED stops flashing and all the debug LEDs turn on. You can define the state of the debug LEDs, if you wish, using software.

Note: If you are using the DT9841E module, the LED is labelled CR6, not LED CR1. Refer to page 11 for the layout of the DT9841E module.

If a module loses power, you must download the program into SDRAM again. Alternatively, if you have a flash version of the module, you can load the program into flash using the DT9840 Series Flash Programmer Utility, described in Chapter 6 starting on page 71. Once a program has been loaded into flash, the program is restarted automatically when the module is powered on.

Performing Memory Tests

Note: You can perform memory tests at any time after the DT9840 Series software has been installed. A DSP program does not have to be running.

The **Memory** tab allows you to debug your DSP application by reading various memory locations on the DSP. When the **Memory** tab is selected, the screen shown in Figure 38 appears.

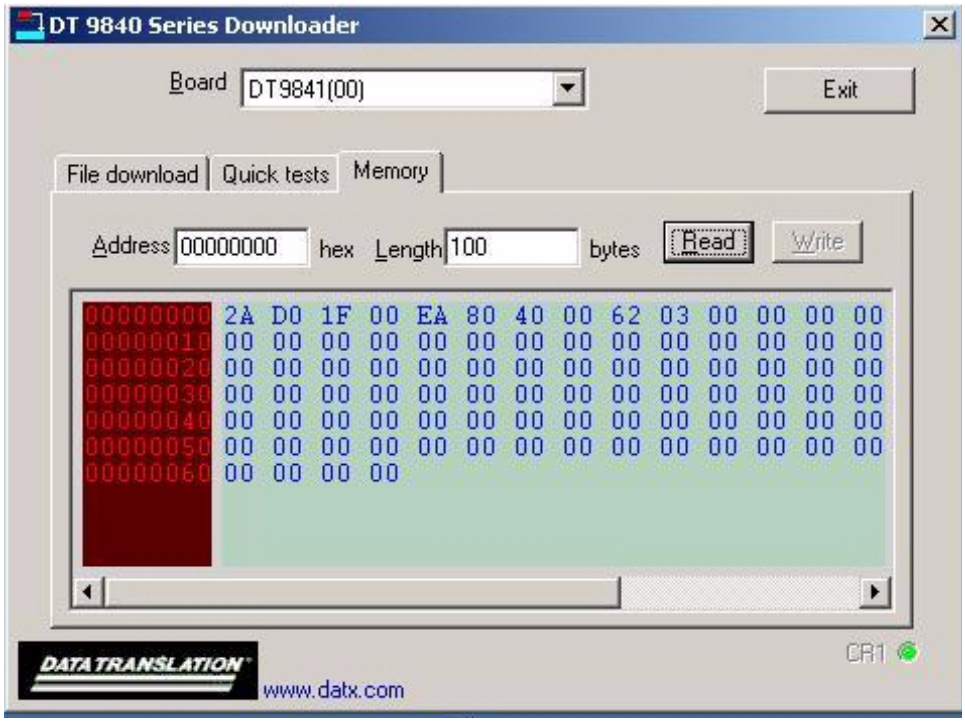


Figure 38: Memory Tab

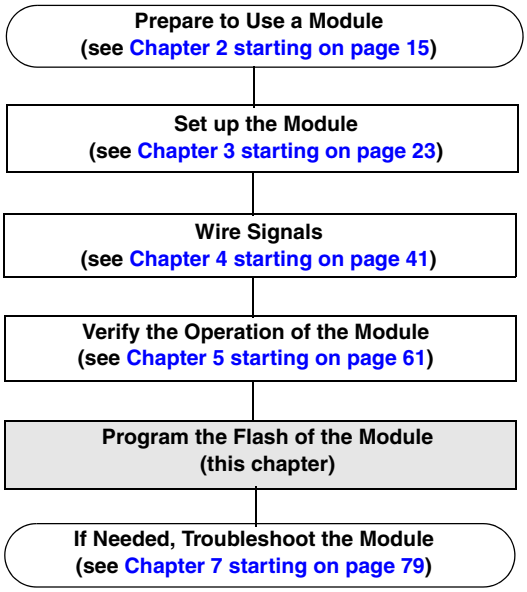
To read the data at specified memory locations, do the following:

1. Enter the hexadecimal value of the starting address in Address text box.
2. Enter the number of bytes of memory to read or write in the Length text box.
3. To read the specified number of bytes from the specified address, click **Read**; to write the specified number of bytes to the specified address, click **Write**.
   The data in the specified locations is displayed.

For more information on the memory locations, refer to the *DT9840 Series User's Manual.*

Programming Flash Memory

Overview 73
Using the DT9840 Series Flash Programmer Utility 74
Programming Flash Memory Using Command-Line Options 77
Constructing a Data File 78


Prepare to Use a Module
(see Chapter 2 starting on page 15)
Set up the Module
(see Chapter 3 starting on page 23)
Wire Signals
(see Chapter 4 starting on page 41)
Verify the Operation of the Module
(see Chapter 5 starting on page 61)
Program the Flash of the Module
(this chapter)
If Needed, Troubleshoot the Module
(see Chapter 7 starting on page 79)

Overview

DT9840 Series modules include 2 MB of flash (nonvolatile) memory. The memory is divided into two sections: a single 64 KB block is reserved for user data; the remaining memory (2 MB – 64 KB) is reserved for storing a DSP program.

Using the DT9840 Series Flash Programmer Utility provided on the DT9840 Series Software CD, you can copy either a DSP program (COFF file) or a user data (DAT) file into the flash memory of the DT9840 Series module. By copying a DSP program into flash, the module can operate autonomously, automatically restarting this program each time it is powered on. By copying a user data into flash, you can ensure that valuable information, such as configuration information or collected data, persists across power cycles, even if the DT9840 Series module loses power or is turned off.

Internally, the DT9840 Series Flash Programmer Utility downloads a small bootloader utility to the flash memory of the module. Once you have loaded a DSP program into flash, the bootloader utility copies the DSP program from flash to SDRAM memory for faster program execution.

Note: Internally, the bootloader utility is copied from flash to the lowest 1 KB of SDRAM. Ensure that your program does not overwrite the lowest 1 KB of SDRAM, or the bootloader will fail to run.

Only one DSP program and one data file can reside in flash memory. However, you can overwrite the flash memory up to one million times with a new or modified DSP program or data file, if you wish.

To ensure proper operation, we highly recommend that you first download your DSP program into the SDRAM of the module (using the DT9840 Series Download Utility described in Chapter 5), and verify that both the program and the module are operating properly before copying a DSP program into flash memory.

Note: Only one DSP program can be running at a time. For example, if you load a program into flash, and then decide to either reprogram the flash or download a program into SDRAM, the running program is aborted when the flash programming or download operation is performed.

Using the DT9840 Series Flash Programmer Utility

To use the DT9840 Series Flash Programmer Utility to copy a DSP program or data file into flash memory, do the following:

1. From Start\Programs\Data Translation, Inc\DT9840 Series, click **DT9840 Series Flash Programmer Utility**.
   A screen similar to Figure 39 appears.

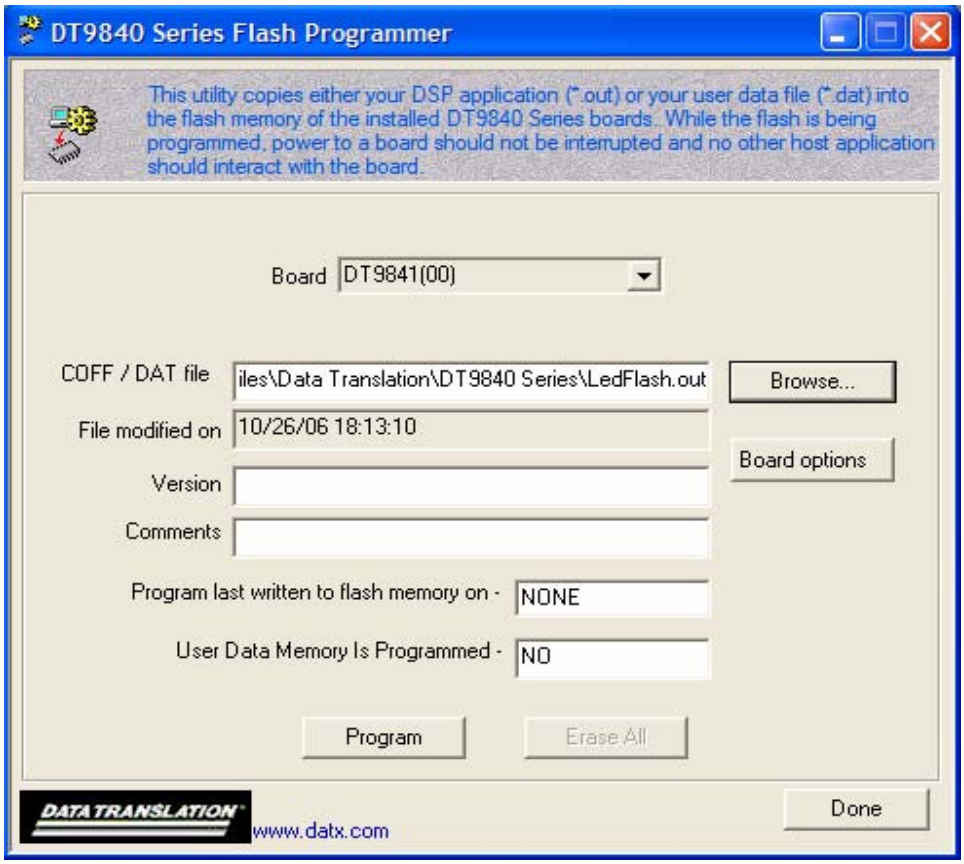

DT9840 Series Flash Programmer
This utility copies either your DSP application (*.out) or your user data file (*.dat) into the flash memory of the installed DT9840 Series boards. While the flash is being programmed, power to a board should not be interrupted and no other host application should interact with the board.
Board
DT9841(00)
COFF / DAT file
iles\Data Translation\DT9840 Series\LedFlash.out
Browse...
File modified on
10/26/06 18:13:10
Board options
Version
Comments
Program last written to flash memory on -
NONE
User Data Memory Is Programmed -
NO
Program
Erase All
DATA TRANSLATION
www.datx.com
Done

Figure 39: DT9840 Series Flash Programmer Utility

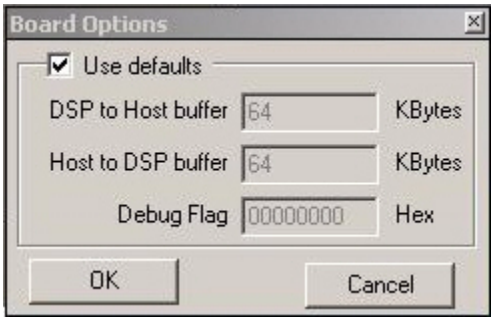
2. From the Board drop-down list, select the DT9840 Series module whose flash you want to program.

Note: If a DSP program is already running on the specified module, the running DSP program is aborted.

Ensure that power is not interrupted to the specified module and that the host program is not communicating with the module during the rest of this procedure.

---

3. In the COFF /DAT file text box, enter or browse to the path of the program (COFF file) or user data file (DAT file) that you want to copy into the flash of the specified module. Note that the user data file must be of the format specified on page 77.
4. If you wish, enter version information for the specified program into the Version text box. This field applies only to program (COFF) files; you can enter up to 32 characters in this field. If a program file already resides in flash, the version of the program, as originally specified, appears in this text box.
5. If you wish, enter comments about the specified program into the Comments text box. This field applies only to program (COFF) files; you can enter up to 256 characters in this field. If a program already resides in flash, the comments related to this program, as originally specified, appear in this text box.
6. Click **Board options**.
   The following dialog box appears:



7. Ensure that the sizes of the communication buffers (used to exchange data between the host program and the DT9840 Series module) and the value of the debug flag (used to control serial debugging on the module) match the values that are specified in the BOARD_OPTIONS structure of your host program (used by the **DT_BoardOpen** function). If the values specified here do not match your host program, an error will result.

   By default, the size of each communication buffer is 64 KBytes and the value of the debug flag is 00000000 (hexadecimal notation). Refer to the *DT9840 Series Host Communication Library Manual* for more information on these parameters.

Note: The DSP to Host buffer and Host to DSP buffer edit boxes accept only numeric characters. The Debug Flag edit box accepts only the hexadecimal characters 0 to 9 and A to F.

If a program already resides in flash, the board options related to this file appear in the edit fields.

---

8. Click **OK** to close the Board Options dialog box.

9. Click **Program**, and then click **Yes** to program the flash with the specified DSP program (COFF) or data (DAT) file.
   The appropriate section of flash memory is erased before the new file is loaded. For example, if you choose to program a data file in flash memory, the 64 KByte section of flash memory is first erased before the new data file is programmed; the program file in the other section of flash memory remains unaffected. When the operation is finished, a message is displayed to indicate that the flash memory was programmed successfully; the date and time of programming are shown.
10. When you are finished with this utility, click **Done**.
11. To run a DSP program from flash, power off, and then power on your module.
    The DSP program restarts automatically each time the module is powered up.

Note: If you want to erase the contents in flash memory, select the **Erase All** button of the DT9840 Series Flash Programmer Utility. Using this button, both the program file and the data file are erased.

Programming Flash Memory Using Command-Line Options

If desired, you can use the following command-line option to copy a DSP program (COFF file) into flash memory:

```
FlashProg Program.out
```

where *Program.out* represents the name of the COFF file to copy into flash memory.

If you want to copy a data file into flash memory from the command-line, use this option:

```
FlashProg Datafile.dat
```

where *Datafile.dat* represents the name of the data file to copy into the reserved area in flash memory. This file must be of the format specified on page 77.

Constructing a Data File

Before programming a data (DAT) file into flash memory, ensure that the data file has the following format:

- USHORT *DataFileID* – This field is always set to 0x009a to indicate that it is a DT9840 data file.
- USHORT *NumBytes* – This field indicates how many bytes (between 1 and 65535) to copy into the reserved 64 KB block in flash memory.
- BYTE *Data[]* – This field specifies the data to copy to the reserved 64 KB block in flash memory.

Note that only the data specified by *Data[]* is copied to flash memory; the values specified by *DataFileID* and *NumBytes* are not copied into flash memory.

7

Troubleshooting

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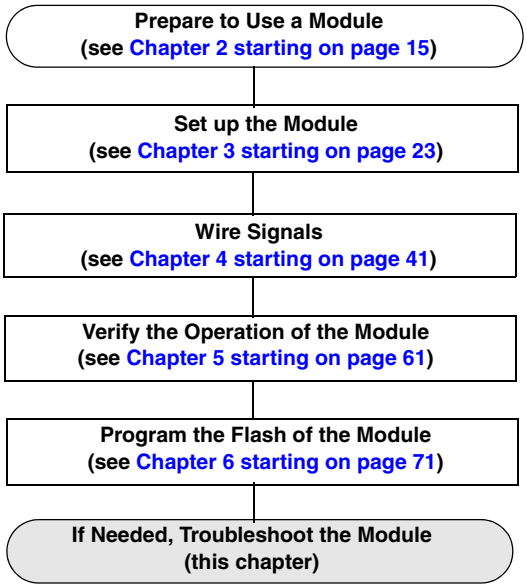
If Your Module Needs Factory Service 84


Prepare to Use a Module
(see Chapter 2 starting on page 15)
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Wire Signals
(see Chapter 4 starting on page 41)
Verify the Operation of the Module
(see Chapter 5 starting on page 61)
Program the Flash of the Module
(see Chapter 6 starting on page 71)
If Needed, Troubleshoot the Module
(this chapter)

General Checklist

Should you experience problems using the DT9840 Series module, follow these steps:

1. Read all the documentation provided for your product, including any "Read This First" information.
2. Check the DT9840 Series Software CD for any README files and ensure that you have used the latest installation and configuration information available.
3. Check that your system meets the requirements stated on page 18.
4. Check that you have installed your software properly using the instructions in Chapter 2 starting on page 15.
5. Check that you have installed your hardware properly using the instructions in Chapter 3 starting on page 23.
6. Check that you have wired your signals properly using the instructions in Chapter 4 starting on page 41.
7. Search the DT Knowledgebase in the Support section of the Data Translation web site (at www.datatranslation.com) for an answer to your problem.

If you still experience problems, try using the information in Table 6 to isolate and solve the problem. If you cannot identify the problem, refer to page 81.

Table 6: Troubleshooting Problems

Symptom	Possible Cause	Possible Solution
Module does not respond.	The module configuration is incorrect.	Check your software settings.
	The module is damaged.	Contact Data Translation for technical support; refer to page 83.
Intermittent operation.	Loose connections or vibrations exist.	Check your wiring and tighten any loose connections or cushion vibration sources; see the instructions in the Chapter 4 starting on page 41.
	The module is overheating.	Check environmental and ambient temperature; consult the module's specifications in Appendix A of the *DT9840 Series User's Manual* and the documentation provided by your computer manufacturer for more information.
	Electrical noise exists.	Check your wiring and either provide better shielding or reroute unshielded wiring; see the instructions in Chapter 4 starting on page 41.
Device failure error reported.	The DT9840 Series module cannot communicate with the Microsoft bus driver or a problem with the bus driver exists.	Check your cabling and tighten any loose connections; see the instructions in Chapter 3 starting on page 23.
	The DT9840 Series module was removed while an operation was being performed.	Ensure that your DT9840 Series module is properly installed; see the instructions in the Chapter 3 starting on page 23.

Table 6: Troubleshooting Problems (cont.)

Symptom	Possible Cause	Possible Solution
Data appears to be invalid.	An open connection exists.	Check your wiring and fix any open connections; see the instructions in Chapter 4 starting on page 41.
	A transducer is not connected to the channel being read.	Check the transducer connections; see the instructions in Chapter 4 starting on page 41.
	The module is set up for differential inputs while the transducers are wired as single-ended inputs or vice versa.	Check your wiring and ensure that the software and hardware are set up as differential; see the instructions in Chapter 4 starting on page 41.
Computer does not boot.	The power supply of the computer is too small to handle all the system resources.	Check the power requirements of your system resources and, if needed, get a larger power supply; consult the module's specifications in Appendix A of the *DT9840 Series User's Manual*.
USB 2.0 is not recognized.	Your operating system does not have the appropriate Service Pack installed.	Ensure that you load the appropriate Windows Service Pack (version 2 for Windows XP). If you are unsure of whether you are using USB 2.0 or USB 1.1, run the Data Translation DT9840 Series Control Panel, described on page 31.
	Standby mode is enabled on your PC.	For some PCs, you may need to disable standby mode on your system for proper USB 2.0 operation. Consult Microsoft for more information

Technical Support

If you have difficulty using a DT9840 Series module, Data Translation's Technical Support Department is available to provide technical assistance.

To request technical support, go to our web site at http://www.datatranslation.com and click on the Support link.

When requesting technical support, be prepared to provide the following information:

- Your product serial number
- The hardware/software product you need help on
- The version of the CD you are using
- Your contract number, if applicable

If you are located outside the USA, contact your local distributor; see our web site (www.datatranslation.com) for the name and telephone number of your nearest distributor.

If Your Module Needs Factory Service

If your module must be returned to Data Translation, do the following:

1. Record the module's serial number, and then contact the Customer Service Department at (508) 481-3700, ext. 1323 (if you are in the USA) and obtain a Return Material Authorization (RMA).

   If you are located outside the USA, call your local distributor for authorization and shipping instructions; see our web site (www.datatranslation.com) for the name and telephone number of your nearest distributor. All return shipments to Data Translation must be marked with the correct RMA number to ensure proper processing.

2. Using the original packing materials, if available, package the module as follows:

   – Wrap the module in an electrically conductive plastic material. Handle with ground protection. A static discharge can destroy components on the module.

   – Place in a secure shipping container.

3. Return the module to the following address, making sure the RMA number is visible on the outside of the box.

   Customer Service Dept.
   Data Translation, Inc.
   100 Locke Drive
   Marlboro, MA 01752-1192

Wiring to the Board-Level Version of the Module

Wiring to the DT9841, DT9842/2, or DT9842/8 Board-Level Version 86
Wiring to the DT9841E Board-Level Version 90

Wiring to the DT9841, DT9842/2, or DT9842/8 Board-Level Version

Note: The DT9841-VIB is not available as a board-level version. It is available in the Sleek Box configuration only.

If you purchased the board-level version of the DT9841, DT9842/2, or DT9842/8 module, you can connect I/O signals to the module in the following ways:

- **BNC connectors** – The BNC labelled TTL Clock is provided for attaching an external clock signal. The BNC labelled TTL Trigger is provided for attaching an external trigger signal.
- **Analog Input Connector (J18)** – A 68-pin connector provided for attaching analog input signals. Refer to Table 7 on page 86 for more information on this connector.
- **Analog Output, Digital I/O, and Counter/Timer Connector (J17)** – A 68-pin connector provided for attaching analog output, digital I/O, and counter/timer signals. Refer to Table 8 on page 88 for more information on this connector.

For information on the other connectors on the module, refer to Appendix B of the *DT9840 Series User's Manual*.

Table 7: Pin Assignments for Connector J18 on a DT9841, DT9842/2, and DT9842/8 Module

Pin	Signal Description	Pin	Signal Description
34	Analog Input 00	68	Analog Input 00 Return[a]
33	Analog Input 01	67	Analog Input 01 Return[a]
32	Analog Input 02	66	Analog Input 02 Return[a]
31	Analog Input 03	65	Analog Input 03 Return[a]
30	Analog Input 04	64	Analog Input 04 Return[a]
29	Analog Input 05	63	Analog Input 05 Return[a]
28	Analog Input 06	62	Analog Input 06 Return[a]
27	Analog Input 07	61	Analog Input 07 Return[a]
26	Reserved	60	Reserved
25	Reserved	59	Reserved
24	Reserved	58	Reserved
23	Reserved	57	Reserved
22	Reserved	56	Reserved
21	Reserved	55	Reserved
20	Reserved	54	Reserved

Table 7: Pin Assignments for Connector J18 on a DT9841, DT9842/2, and DT9842/8 Module (cont.)

Pin	Signal Description	Pin	Signal Description
19	Reserved	53	Reserved
18	Reserved	52	Reserved
17	Reserved	51	Reserved
16	Reserved	50	Reserved
15	Reserved	49	Reserved
14	Reserved	48	Reserved
13	Reserved	47	Reserved
12	Reserved	46	Reserved
11	Reserved	45	Reserved
10	Reserved	44	Reserved
9	Reserved	43	Reserved
8	Reserved	42	Reserved
7	Reserved	41	Reserved
6	Reserved	40	Reserved
5	Reserved	39	Reserved
4	Reserved	38	Reserved
3	Reserved	37	Reserved
2	Amp Low	36	Analog Common
1	+5 V Isolated Output	35	Isolated Power Ground

a. For the DT9842/2 and DT9842/8, which have single-ended analog inputs, these signals are analog grounds.

Table 8: Pin Assignments for Connector J17 on a DT9841, DT9842/2, and DT9842/8 Module

Pin	Signal Description	Pin	Signal Description
34	Analog Output 00	68	Analog Output 00 Return
33	Analog Output 01	67	Analog Output 01 Return
32	Analog Output 02[a]	66	Analog Output 02 Return[a]
31	Analog Output 03[a]	65	Analog Output 03 Return[a]
30	Analog Output 04[a]	64	Analog Output 04 Return[a]
29	Analog Output 05[a]	63	Analog Output 05 Return[a]
28	Analog Output 06[a]	62	Analog Output 06 Return[a]
27	Analog Output 07[a]	61	Analog Output 07 Return[a]
26	External D/A Trigger[b]	60	Isolated Digital Ground
25	External D/A Clock[b]	59	Isolated Digital Ground
24	External A/D Trigger[b]	58	Isolated Digital Ground
23	External A/D Clock[b]	57	Isolated Digital Ground
22	Digital Input Trigger[b]	56	Isolated Digital Ground
21	Digital Input Clock[b]	55	Isolated Digital Ground
20	Digital Output Trigger[b]	54	Isolated Digital Ground
19	Digital Output Clock[b]	53	Isolated Digital Ground
18	Digital Input/Output 3, Port 0	52	Digital Input/Output 7, Port 0
17	Digital Input/Output 2, Port 0	51	Digital Input/Output 6, Port 0
16	Digital Input/Output 1, Port 0	50	Digital Input/Output 5, Port 0
15	Digital Input/Output 0, Port 0	49	Digital Input/Output 4, Port 0
14	Digital Input/Output 3, Port 1	48	Digital Input/Output 7, Port 1
13	Digital Input/Output 2, Port 1	47	Digital Input/Output 6, Port 1
12	Digital Input/Output 1, Port 1	46	Digital Input/Output 5, Port 1
11	Digital Input/Output 0, Port 1	45	Digital Input/Output 4, Port 1
10	Digital Input/Output 3, Port 2/TINP1[b]	44	Digital Input/Output 7, Port 2
9	Digital Input/Output 2, Port 2/Encoder 2 Clr[b]	43	Digital Input/Output 6, Port 2
8	Digital Input/Output 1, Port 2/Encoder 1 Clr[b]	42	Digital Input/Output 5, Port 2
7	Digital Input/Output 0, Port 2/Encoder 0 Clr[b]	41	Digital Input/Output 4, Port 2
6	User Clock Input 0/Encoder A0[b]	40	Isolated Digital Ground
5	User Counter Output 0	39	External Gate 0/Encoder B0[b]
4	User Clock Input 1/Encoder A1[b]	38	Isolated Digital Ground

Table 8: Pin Assignments for Connector J17 on a DT9841, DT9842/2, and DT9842/8 Module (cont.)

Pin	Signal Description	Pin	Signal Description
3	User Counter Output 1	37	External Gate 1/Encoder B1[b]
2	User Clock Input 2/Encoder A2[b]	36	Isolated Digital Ground
1	User Counter Output 2	35	External Gate 2/Encoder B2[b]

a. Available on the DT9842/8 module only.
b. Currently, this function is not implemented.

Wiring to the DT9841E Board-Level Version

If you purchased the DT9841E module, you can connect I/O signals to the module in the following ways:

- **Analog Input Connector (J2)** – A 68-pin connector provided for attaching analog input signals. Refer to Table 9 for more information on this connector.
- **Analog Output, Digital I/O, and Counter/Timer Connector (J1)** – A 68-pin connector provided for attaching an analog output, digital I/O, and counter/timer signals, as well as an external trigger or clock. Refer to Table 10 for more information on this connector.

For information on the other connectors on the module, refer to Appendix B of the *DT9840 Series User's Manual*.

Table 9: Pin Assignments for Connector J2 on a DT9841E Module

Pin	Signal Description	Pin	Signal Description
34	Analog Input 00	68	Analog Input 00 Return
33	Analog Input 01	67	Analog Input 01 Return
32	Reserved	66	Reserved
31	Reserved	65	Reserved
30	Reserved	64	Reserved
29	Reserved	63	Reserved
28	Reserved	62	Reserved
27	Reserved	61	Reserved
26	Reserved	60	Reserved
25	Reserved	59	Reserved
24	Reserved	58	Reserved
23	Reserved	57	Reserved
22	Reserved	56	Reserved
21	Reserved	55	Reserved
20	Reserved	54	Reserved
19	Reserved	53	Reserved
18	Reserved	52	Reserved
17	Reserved	51	Reserved
16	Reserved	50	Reserved
15	Reserved	49	Reserved
14	Reserved	48	Reserved
13	Reserved	47	Reserved

Table 9: Pin Assignments for Connector J2 on a DT9841E Module (cont.)

Pin	Signal Description	Pin	Signal Description
12	Reserved	46	Reserved
11	Reserved	45	Reserved
10	Reserved	44	Reserved
9	Reserved	43	Reserved
8	Reserved	42	Reserved
7	Reserved	41	Reserved
6	Reserved	40	Reserved
5	Reserved	39	Reserved
4	Reserved	38	Reserved
3	Reserved	37	Reserved
2	Amp Low	36	Analog Common
1	+5 V Isolated Output	35	Isolated Power Ground

Table 10: Pin Assignments for Connector J1 on a DT9841E Module

Pin	Signal Description	Pin	Signal Description
34	Analog Output 00	68	Analog Output 00 Return
33	Analog Output 01	67	Analog Output 01 Return
32	Reserved	66	Reserved
31	Reserved	65	Reserved
30	Reserved	64	Reserved
29	Reserved	63	Reserved
28	Reserved	62	Reserved
27	Reserved	61	Reserved
26	External D/A Trigger[a]	60	Isolated Digital Ground
25	External D/A Clock[a]	59	Isolated Digital Ground
24	External A/D Trigger[b]	58	Isolated Digital Ground
23	External A/D Clock[c]	57	Isolated Digital Ground
22	Digital Input Trigger[a]	56	Isolated Digital Ground
21	Digital Input Clock[a]	55	Isolated Digital Ground
20	Digital Output Trigger[a]	54	Isolated Digital Ground
19	Digital Output Clock[a]	53	Isolated Digital Ground
18	Digital Input/Output 3, Port 0	52	Digital Input/Output 7, Port 0

Table 10: Pin Assignments for Connector J1 on a DT9841E Module (cont.)

Pin	Signal Description	Pin	Signal Description
17	Digital Input/Output 2, Port 0	51	Digital Input/Output 6, Port 0
16	Digital Input/Output 1, Port 0	50	Digital Input/Output 5, Port 0
15	Digital Input/Output 0, Port 0	49	Digital Input/Output 4, Port 0
14	Digital Input/Output 3, Port 1	48	Digital Input/Output 7, Port 1
13	Digital Input/Output 2, Port 1	47	Digital Input/Output 6, Port 1
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5	User Counter Output 0	39	External Gate 0/Encoder B0[a]
4	User Clock Input 1/Encoder A1[a]	38	Isolated Digital Ground
3	User Counter Output 1	37	External Gate 1/Encoder B1[a]
2	User Clock Input 2/Encoder A2[a]	36	Isolated Digital Ground
1	User Counter Output 2	35	External Gate 2/Encoder B2[a]

a. Currently, this function is not implemented.
b. Use this pin to connect an external trigger to the DT9841E module.
c. Use this pin to connect an external clock to the DT9841E module.

Windows Administrator Permissions

On some systems, you may encounter permissions problems if your Administrator permissions are not set up properly.

To allievate this problem, configure the UAC settings of your system as follows:

1. From Windows, click the **Start** button.
2. Type **User account control**, and press **Enter**.
3. When the **User account control settings box** appears, move the slider to **Never notify**, and click **OK**.

Contact your system administrator and/or refer to your Windows documentation for more information.

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